Products Finishing

FRED W. VOGEL, Editor

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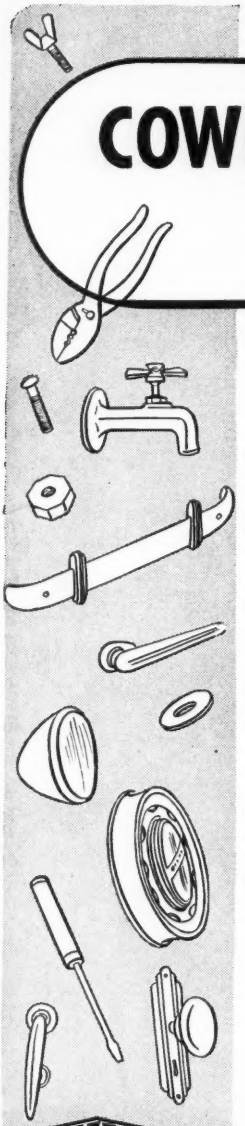

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Products finishing

METHODS for handling work between processing operations constitute a phase of metal finishing practice that should be carefully investigated especially now that fast production schedules are going into effect in many manufacturing plants.

Experience has shown that much of the confusion in the average finishing shop is the result of improper handling of work, and that this confusion could be reduced considerably or eliminated entirely if more practical methods for transferring work from one operation to the next were adopted. Proper layout of processing equipment, in many cases, will be the determining factor in the selection of the best methods for handling the work.

An industrial engineer of many years experience points out that there are two items in shop management that must be concentrated upon in any program of plant modernization. First, get all tools and materials off the floor and up onto tables, workbenches, or other properly designed and properly allocated equipment. Second, relieve the workmen of mechanical handling of materials as far as possible.

Use automatic conveyors if production is great enough to warrant; use roller conveyors for tote pans or baskets and overhead conveyors for racks if possible; use hoists on monorails for dipping work into or out of tanks—but by all means, get the work out of the workmen's hands. Any move in this direction will be a long step toward modernization.

FEBRUARY, 1941 **Vol. 5, No. 5**

How the Army Buys
War Department Awards Contracts For $85,729,251
$34,500,000 MORE DEFENSE ITEMS WIN JOINT O. K
NAVY NOW SPENDING $12,705,000 HERE
HIGHWAYS PROGRAM
ARMY ORDERS PLANES TO COST
ARMY, NAVY AWARDS PUT AT $88,320,236
Artillery Shells Purchased by Army
20,000 Contracted for, Including Navy Craft

Finishing for Defense

With special permission granted by the New Jersey Zinc Company we present one of the most comprehensive treatments ever published on the subject of materials required for finishing armament.

THE greatest defense program in American history is now under way. Front pages tell a story of spending for barracks and blankets, for shells and ships, for planes and Panama Canal locks—a total which is certain to exceed 13 billions of dollars. What does it all mean in terms of finishing materials?

It means perhaps the greatest challenge to technical skill that the ready-mixed finishing material industry and its 2,000 trained chemists have ever faced. It means not volume alone, but variety of products. Mark well that keynote -- variety of products. Finishes for shells, targets or camouflage. Uncle Sam has provided for them. Everything from shells to ships, from cantonments to cannon must be protected from rust, corrosion, and the destructive forces of the elements.

In some 70 odd specifications, the Army has foreseen just about every finishing contingency that might be expected to arise. The Navy has more than 100 paint, pigment and raw material specifications tailored to its needs; the Maritime Commission close to 50. And as other Government agencies (FWA, USHA, FHA, The Panama Canal are a few) and private industry swing into concerted action, scores of other specifications will guide the selection and purchase of finishing material. Among the better known standards that will be utilized are the Federal Specifications prepared and issued whenever two or more U. S. Government Departments make a request.

The total volume of finishing material that will be consumed cannot be estimated accurately—yet. Some criterion may be found in finishing material orders already placed. Another yardstick is the actual amount of money slated for government defense construction. Latest estimates place that figure at 2.7 billions, taking into account additional funds not specifically appropriated by Congress in defense bills:

Navy	
Continental Airbases,	$ 160,007,000
Pacific Airbases	40,047,000
Alaskan Airbases ...	17,555,000
Panama and Caribbean Airbases	33,570,000
Continental Yards and Establishments	213,756,000
Non-Continental Yards and Establishments	63,588,862
Agency Shipbuilding and Ordnance Plants	200,000,000
Defense Worker Housing	50,000,000
Total.....	$ 778,523,862

War Department	
Draft Army Training Camps	$ 330,000,000
National Guard Training Camps	100,000,000
Army Posts	100,000,000
Continental Airbases.	100,000,000
Alaska, Hawaii and Panama Airbases..	25,000,000
Agency Munitions Plants	500,000,000
Defense Worker Housing	50,000,000
Total.....	$1,205,000,000

Federal Works Agency and Others	
PRA—Highways ....$	200,000,000
CAA—Airfields	40,000,000
PBA, RFC, USHA—Housing	230,000,000
WPA — Misc. Work at Navy Yards, Army Posts	250,000,000
Total.....$	720,000,000
Grand Total.....$	2,703,523,862

War Department Photo

Army maneuvers during the latter part of 1940 gave impetus to plans for strengthening or reconstructing some 1,800 bridges in the nation. Finishing will play an important part in proposed expenditures.

War Department Photo

Rusty cannon are not of much use. That's the reason this 155 mm. Howitzer, like all Army guns, is finished overall for protection and then stenciled. Even its shells must be painted for protection against corrosion.

•

Construction work for the Army is centralized in the office of the Quartermaster General, which means that contract work not only passes through the Federal Works Agency and its subdivisions, but in many cases is placed direct with private organizations. Now under construction, or already in existence, are some 100 odd major training centers, some of which will provide facilities for as many as 25,000 men.

A large proportion of the defense appropriation has been allotted to such items as the finishing of ammunition, guns, planes, and the replacement or reinforcement of 1,800 sub-standard bridges on roads giving access to cantonments and reservations. A still more comprehensive view takes into account Navy plans for 200 new warships, expansion of existing shipyard facilities and Naval housing at 12 bases, as well as an augmented American merchant marine.

Battleships are large by any conception, including the volume of material needed to finish them. Reliable

War Department Photo

Targets illustrate an important phase of army finishing, which in many respects is just as varied and even more complex than general industrial finishing.

How to wipe out nickel plating rejects

A large commercial plater was in deep trouble. He was working on a very large order -- 70,000 pieces to be nickel-plated each day. The first week's production left him almost frantic for rejects for faulty finish averaged 30% -- over 21,000 pieces had to be scrapped every day!

The fault was not in the nickel plating. He knew what he needed -- a good smooth undercoating -- a bright surface which could be obtained cheaply and quickly. But he knew also he could not afford to buff or polish the steel for that was not only slow but too expensive. So he put in du Pont High Speed Copper and his troubles were over. Rejects were reduced to only 10 to 15 pieces daily.

The smooth, fine-grained undercoating obtained by the du Pont High Speed Copper process is the solution to many a nickel plating problem. You can get quickly, and economically, a bright plate that's easy to buff or immediately suitable for direct deposition of nickel. Here are more reasons why for *every nickel plating job* you should consider:

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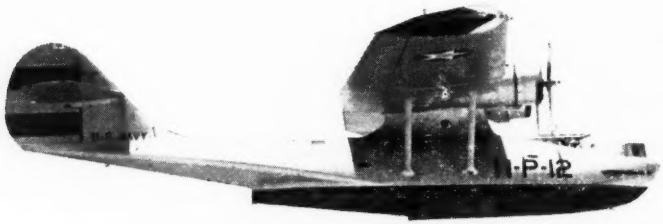
estimates place the amount of exterior finishing material required for each coat on a 35,000-ton battleship at upwards of 900 gallons. A new warship will require many coats of finishing material, a refinish job at least two coats.

Currently, every unit in the American merchant marine is being built to naval specifications and is quickly convertible into a fleet auxiliary. Since January 1, 1938, the Maritime Commission has placed contracts for the construction of 174 ocean-going steamships aggregating about 1,900,000 gross tons. Selection of finishes for such ships is a highly specialized task and is guided by over 50 specifications issued by the Commission. A small idea of the volume of finishing material involved may be gained from the fact that it takes about 450 gallons to give the superstructure of a 20,000-ton merchant ship one coat of exterior finishing material.

There's no question — Uncle Sam is faced with the biggest painting job in defense history. And it's a job in which zinc pigments—zinc oxide, zinc sulfide, lithopone, zinc dust, and zinc chromate—will play a mighty important part. For example, the amounts of zinc oxide used in government specification paints range as high as 61 per cent. (Leading exterior paints being manufactured today have an average zinc oxide content of approximately 30 per cent.) Among other zinc pigments, lithpone will enter into such important specification paints as TT-P-51a, cold water paints and primers, as well as numerous Army paints.



Flying fortresses have given rise to speculation concerning the use of finishing material to make them invisible. More firmly established, however, is the use of zinc chromate primers for protection of their alloys.

Because of their wide interest to finishing material manufacturers, consumers, and specifiers, PRODUCTS FINISHING presents on this and the following pages, abstracts* of some of the more important paint specifications to be used by various government agencies.

Federal Specifications

TT-P-53 Chrome Yellow, Paint, Exterior

Color: War Dept. Yellow 4.

Pigment: min. 62 per cent, consisting of lead chromate (with or without other insoluble compounds of lead) 60 per cent, zinc oxide 15-20 per cent, and not more than 20 per cent extenders. The chromium content must be not less than 52 per cent expressed as $PbCrO_4$, and the lead not less than 56 per cent expressed as $PbSO_4$.

Liquid: max. 38 per cent, consisting of not less than 80 per cent linseed oil.

** Federal Specification abstracts are adapted from Circular No. 600 of the Scientific Section, National Paint, Varnish and Lacquer Association, Inc. The remaining abstracts were prepared by The New Jersey Zinc Company. Individuals using these abstracts should in all cases assure themselves that the specifications are still current.*

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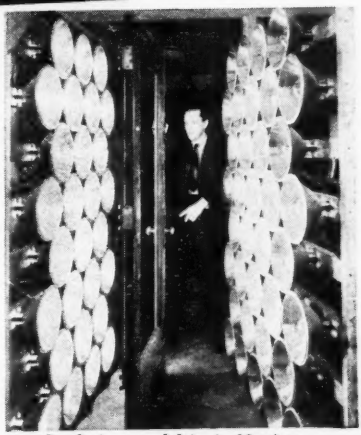
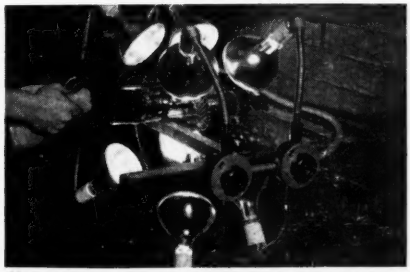


Synthetic enamel dries in 12 minutes under these drying lamps mounted on two portable racks.



Above: A motor repair shop uses eight 250 watt R-40 bulb drying lamps mounted on flexible arms for drying and baking varnish on armatures, rotors, stators and field pieces.

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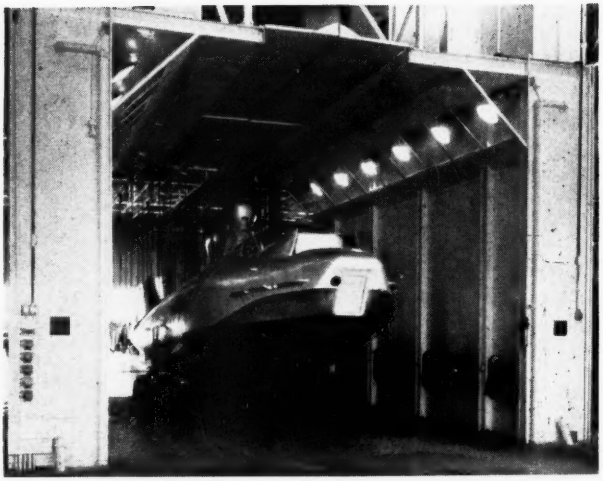

The hulls of the Consolidated Model 28 twin engined flying boats (U. S. Navy PBY) are finished in spray booths of the type shown here.

•

the balance to be 10 per cent long oil spar varnish and 10 per cent combined drier and thinner.

General Requirements: Weight per gallon: min. 15 pounds.

TT-P-81, Olive-Drab Paint, Exterior

Pigment: white lead (basic carbonate, basic sulphate, or mixtures thereof) min. 35 per cent; zinc oxide min. 30 per cent; white mineral pigments, pure tinting colors or mixtures thereof max. 30 per cent; organic colors none; sulphide sulphur none; in no case shall the sum of basic lead carbonate, basic lead sulphate, and zinc oxide be less than 70 per cent.

Semi-Paste: pigment max. 77 per cent, min. 73 per cent; linseed oil max. 27 per cent, min. 23 per cent; moisture and other volatile matter max. 0.7 per cent; coarse particles and skins max. 2 per cent; weight per gal. min. 18 pounds.

Ready Mixed Paint: pigment max. 66 per cent, min. 62 per cent; liquid (containing min. 85 per cent linseed oil) max. 38 per cent, min. 34 per cent; water max. 0.5 per cent; coarse particles and skins max. 2 per cent; weight per gal. min. 15 pounds.

TT-P-101a, Paint, Titanium-Zinc and Titanium-Zinc-Lead. Outside, Ready Mixed, White

Pigment; Type A: min. 68 per cent by weight, consisting of titanium dioxide min. 7 per cent, zinc oxide max. 25 per cent, white lead min. 58 per cent (equivalent to basic carbonate), extenders max. 10 per cent, water soluble matter max. 0.8 per cent.

Type B: min. 58 per cent by weight, consisting of titanium dioxide min. 15 per cent, zinc oxide 30-35 per cent, white lead none, extenders max. 55 per cent, water soluble matter max. 0.8 per cent.

Vehicle: Type A max. 32 per cent (linseed oil min. 75 per cent), water max. 1.0 per cent.

Type B: max. 42 per cent (linseed oil min. 85 per cent), water max. 1.0 per cent, no lead in any form.

General Requirements: Weight per gal.: Type A, min. 17 lbs.; Type B, min. 13 lbs. Apparent daylight reflectance relative to magnesium oxide: min. 75 per cent for both types.

TT-P-641, Zinc Dust-Zinc Oxide Primer for Galvanized Surfaces

Type I

Pigment: 78-81 per cent, consisting of zinc dust (96 per cent Zn) 79-81 per cent, zinc oxide (lead-free) 19-21 per cent. Tinting pigments up to 10 per cent of the zinc oxide may be selected from the following: iron oxide, chrome green, chrome oxide green, chrome yellow, burnt umber, zinc chromate.

Liquid: 21-19 per cent, consisting of raw linseed oil 89-91 per cent, thinner 4-5 per cent, drier 5-6 per cent.

General Requirements: The paint must weigh no less than 23 lbs. per gal., and shall dry within 18 hours.

Type II

Pigment: 61-65 per cent, requirements same as in Type I.

Liquid: 39-35 per cent, consisting of not less than 43 per cent non-volatile matter, and not less than 11 per cent glyceryl phthalate; no rosin or rosin derivatives.

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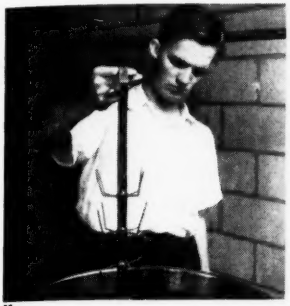

Extreme left: — Hand dipping of plating racks in drum of Miccrolite. Left:—After application, racks will air-dry quickly. Force drying with heat is also employed.

THERE are no "tricks" in the application of any "Miccro" product. Any employee in your plant who is of average intelligence can handle the work and apply most effective protective coatings.

In applying MICCRO-SUPREME STOP-OFF LACQUERS or MICCRO-LITE for coating plating racks the dipping process is recommended. In these operations, it is only necessary dipping speeds be maintained...that the necessary number of coats be applied . . . and that sufficient drying time be allowed. Air drying of both materials is extremely fast, and it is now possible to also force-dry the materials at 125° to 150° Fahrenheit providing further reduction in drying time. No preparatory work other than cleaning the surface to be coated is required.

MICCROLAC is the new water-white, non-blushing protective coating used to protect and beautify natural metal or plated surfaces. It has proved to have excellent adhesion to cadmium, chrome or other greasy type surfaces, and is an effective primer for colored lacquers and bronzing liquids. It is particularly adaptable as a protective coating for silver plated, polished brass or brass plated products and is used on copper, aluminum, wrought iron, stainless steel, etc. Unlike other lacquers of its type, it comes ready for use, eliminating time and guesswork in adding thinner and assuring proper application.

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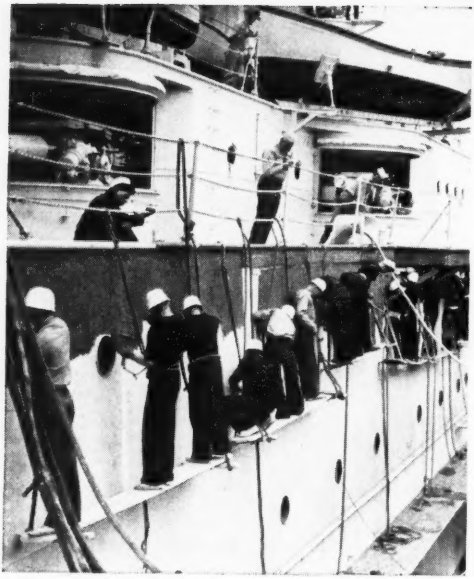


Sailors go to work on the U. S. S. Pennsylvania. In the chipping operation preceding painting, it is not unusual to remove a carload or more of scale and old paint to keep the ship's total burden of finishing material at a minimum.

U. S. Navy Photo

General Requirements: The paint shall weigh not less than 16 lbs. per gal. and shall pass the following tests. Dilution: remain stable after being thinned with ¼ volume of mineral spirits. Drying: set-to-touch, ½ to 4 hours; dry hard, not more than 18 hours. Baking, adhesion and flexibility: film on galvanized iron, dried 18 hours and baked 3 hours at 177 deg. C., shall not check or wrinkle, shall adhere satisfactorily under knife test; film on tin-plate, baked 24 hours at 105-110 deg. C. and then cooled 15 minutes at 25 deg. C., shall not crack when bent over a ⅛-in. rod.

Type III

Pigment: 78-81 per cent, requirements same as in Type I.

Liquid: 22-19 per cent, straight phenolic resin varnish (50-gal. length). Non-volatile matter min. 50 per cent. Kauri reduction min. 140 per cent. Water resistance, cold, 24 hours; hot (75 deg. C.), 6 hours. Rosin or rosin derivatives, none.

General Requirements: The paint shall weigh not less than 22.5 lbs. per gal., and shall pass the Dilution Drying Baking, and Adhesion tests as described under Type II.

354, Enamel, Glyceryl Phthalate, Marine, Interior, White, High Gloss

Pigment: 29.5-33.5 per cent, consisting of titanium-dioxide 88-92 per cent, zinc oxide 9.5-10.5 per cent, ultramarine blue trace.

Vehicle: 66.5-70.5 per cent, consisting of synthetic resin (containing not less than 38 per cent glyceryl phthalate) 54.5-58.5 per cent, volatile thinner (petroleum hydrocarbons) 41.5-45.5 per cent.

General Requirement: Viscosity: min. 2 poises. Coarse particles and skins: max. 0.3 per cent on 325 sieve. Flash point: min. 30 deg. F. Water: max. 1 per cent. Drying: set-to-touch max. 5 hours; dry hard max. 24 hours. Surface: free from brush marks, free from orange peel on spraying. Skinning: slight in half-filled container after 24 hours. Self-lifting: none after 24-hour drying. Gloss: high. Reflectance: min. 82 per cent. Flexibility: no cracking when brushed film baked 2 hours at 195 deg. to 205 deg. F. on tin panel is bent over ⅛-in. mandrel after immersion in cooling water at 22 deg. to 28 deg. C. Brushing and packaging: satisfactory. Weight per gal.: 10 pounds.

356, Paint, Glyceryl Phthalate, Marine Exterior, Basic Lead Chromate-Red Lead-Zinc Oxide

Pigment: 59-63 per cent, consisting of basic lead chromate 50 per cent, red lead 25 per cent, zinc oxide min. 15 per cent, siliceous inert balance.

Vehicle: 41-37 per cent, consisting of synthetic resin (glyceryl phthalate type in which the resin contains not less than 35 per cent glyceryl phthalate), non-volatile 37.5-42.5 per cent, volatile thinner (petroleum hydrocarbons) 62.5-57.5 per cent.

General Requirements: Viscosity: 2 poises at 25 deg. C. Water: max. 1.5 per cent. Coarse particles and skins: max. 0.5 per cent on 325 mesh. Flash point: min. 30 deg. C. Set to touch: 4 hours. Dry hard: 18 hours. Surface: free from brush marks, free from orange peel on spraying. Self-lifting: none after 24 hours drying. Gloss: dull. Flexibility: no cracking when brushed film is baked on tin panel and bent over ⅛-in. rod after water immersion. Water resistance: brushed film 18 hours. Gasoline resistance: 24 hours. Brushing and packaging: satisfactory. Weight per gal.: min. 15½ lbs. Safety: free from toxic ingredients.

Army Air Corps

3-98-D, Enamel for Aircraft

Pigments: variable.

Liquid: high-grade water-resistant spar varnish.

General Requirements: air-drying and suitable for force drying at 225 deg. F. max. Shall produce satisfactory protective coatings with or without undercoats. High gloss, good brushing, covering, leveling, free from skin and lumps, easily mixed as received and after 9 months' storage. Dry hard in 24 hours, set in 8 hours. Water resistance: cold water 24 hours. Must stand flexing over ⅛ in. rod after 24-hour bake at 100 deg. C. Weathering test: 6 months at 45 deg. South versus standard Gas test: after ½-hour exposure, shall not show frosting or other defects.

3-156, Primer, Metal, Oil Base, Dope and Lacquer Proof for Aircraft

Pigment: min. 30 per cent by weight. Wide latitude in selection of raw materials.

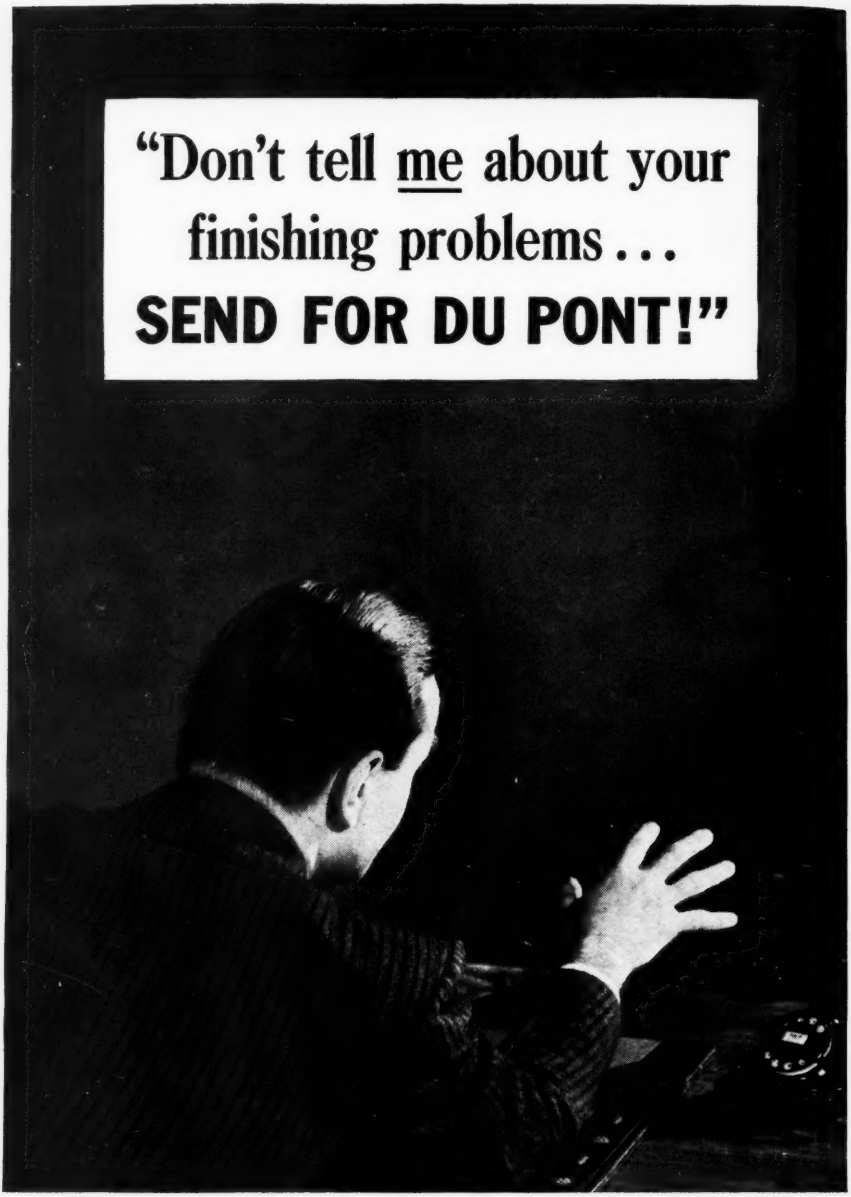
General Requirements: suitable as a protective coating for metal with or without finish coat of varnish enamel, lacquer or dope. Viscosity such that thinning 20 per cent with mineral spirits gives a viscosity ± 10 per cent of standard oil of 17 sec. (Saybolt-Furol visc. at 25 deg. C.) Drying: dope and lacquer proof in 16 hours, and shall not lift if sprayed after long drying period. Must stand flexing over ⅛-in. rod. Must stand immersion in gasoline 24 hours. Must protect duralumin against salt water.

3-159-B, Dope, Semi-Pigmented Cellulose Nitrate, Air Corps Formula

Composition: Clear dope: wet nitrocellulose 10 parts, butyl acetate 10 parts, butyl alcohol 20 parts, ethyl acetate 23 parts, toluene 27 parts. Various color pastes, e.g., yellow paste; cadmium lithopone 32 parts, castor oil 11 parts, dibutyl phthalate 11 parts, cadmium yellow to color. Cream paste: zinc oxide 22 parts, castor oil 11 parts, dibutyl phthalate 11 parts, chrome yellow to color. Light blue paste: zinc oxide 22 parts, castor oil 11 parts, dibutyl phthalate 11 parts, prussian blue, and so on

U. S. Navy Photo

Navy plans for 200 new warships mean finishing on a vast scale. Upwards of 900 gallons of finishing material are required to give a ship of this size one exterior coating.



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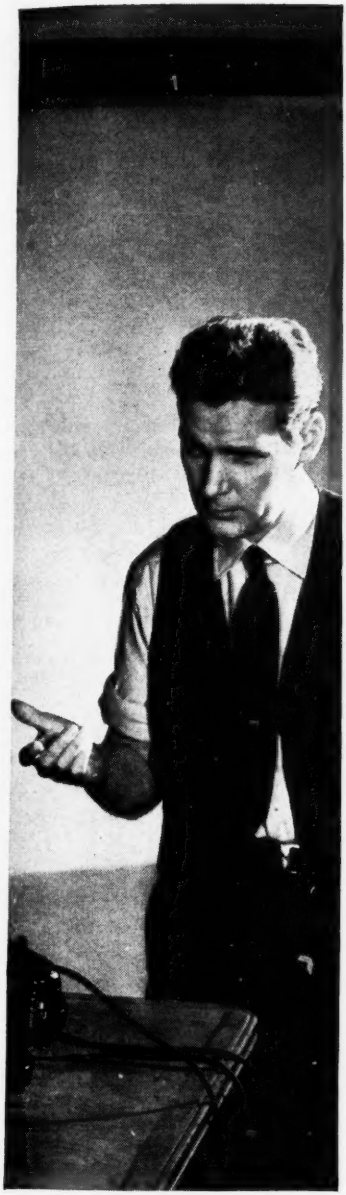

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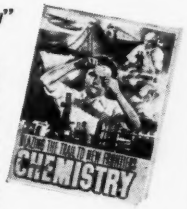


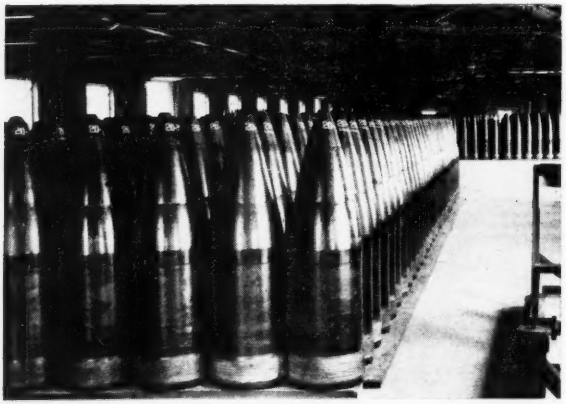
FINISHES DIVISION, WILMINGTON, DELAWARE DU PONT REG. U.S. PAT. OFF.

to color. Dopes made from mixture of clear dope and pastes.

14080, Primer, Metal; Zinc Chromate

Pigment: min. 30 per cent, consisting of zinc chromate min. 85 per cent, extender max. 15 per cent.

Vehicle: non-volatile min. 28 per cent.



War Department Photo

Painting shells inside and out prevents corrosion from powder and the weather, also identifies the contents. Distinctive colors and insignia in use are red cross for mustard gas, green cross for phosgene.

General Requirements: Viscosity: when thinned with equal volume of toluene, shall be suitable for spray application (15-30 centipoises). Drying time: dry to handle max. 30 minutes. Lacquer resistance: shall dry lacquer proof in 4 hours and shall show no lifting characteristics when sprayed with lacquer after a longer drying period. Flexibility: shall withstand bending over 1/8-in. rod. Gasoline resistance: 4 hours. Working properties: satisfactory for spraying and undercoating. Durability: satisfactory on aluminum alloy after 6 months' exposure on Air Corps land rack and Air Corps tidewater rack at Miami, Florida.

U. S. Army Specifications

3-47A, Paint, Blue, Flag Blue

Pigment: 48-52 per cent consisting of lithopone min. 50 per cent, aluminum silicate and color, balance.

Liquid: 52-48 per cent, consisting of raw linseed oil min. 65 per cent, thinner and drier, balance. No other specifications.

3-55, Paint, Olive Drab, for Temporary Work

Color: Shade 22.

Pigment: 48-52 per cent, consisting of white lead min. 15 per cent, zinc oxide min. 10 per cent, aluminum silicate, magnesium silicate, silica, and tinting colors and pigments, balance.

Liquid: 52-48 per cent, consisting of raw linseed oil 70 per cent, drier and turpentine or thinner, or a mixture, balance.

General Requirements: Dry in 18 hours. Weight per gal.: min., 11½ lbs.

3-61, Stencil White Paint

Pigment: 53 - 37 per cent, consisting of zinc oxide 25 per cent, basic sulphate of white lead min. 25 per cent, calcium carbonate balance.

Liquid: 47-43 per cent, consisting of spar varnish 70 per cent, thinner and drier balance.

General Requirements: Shall dry rapidly to a flat finish.

3-65, Paint, Camouflage, Cream, Green, Yellow, and So On

Pigment: 68-72 per cent, consisting of white lead min. 40 per cent, zinc oxide min. 20 per cent, magnesium silicate and tint colors balance.

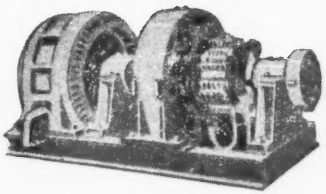
Liquid: 32-38 per cent, consisting of treated oils or spar varnish, or mixture thereof, thinners and driers. Non-volatile min. 42 per cent, of which 80 per cent min. is linseed oil or bodied Chinawood oil, or mixture thereof.

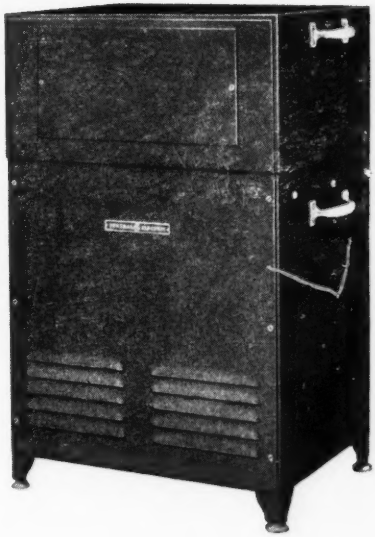
General Requirements: Weight per gal.: min. 16 lbs. Shall dry in 6 hours to a flat finish.

3-67C, Paints for Ammunition

Pigments: Variable with color, e.g.: White paint: pigment 58-62 per cent, consisting of lithopone min. 88 per cent, zinc oxide min. 8 per cent. Olive green paint: pigment 58-62 per cent, consisting of lithopone min. 50 per cent, zinc oxide and tinting matter balance. Blue paint: pigment 41-45 per cent, consisting of

HOW TO GET EXTRA AMPS. WITH A SMALL INVESTMENT





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1 A certain company, due to greatly increased orders, found that it was necessary to add another plating tank. Their motor generator set was already furnishing its peak D-c. output. Rather than buy a completely new motor generator, this company purchased a G-E Copper Oxide Rectifier for the one tank which it had to add. In this manner they obtained very economically the additional D-c. which they needed.

2 Another concern took an order for some plating work which demanded greater D-c. amperage in their tanks than could be furnished by their motor generator. They installed a G-E Copper Oxide Rectifier on one of the tanks and divided among the other tanks the motor generator output which was saved by this change. The result—more D-c. amperage in all tanks accomplished with only a small investment.

3 A third company used their motor generator set to furnish D-c. to their cleaning tank as well as to their plating tanks. They needed a higher D-c. input to their plating tanks This was accomplished by installing a G-E Copper Oxide Rectifier to handle the D-c. demands of the cleaning tank. The amperage saved in this manner was divided among the plating tanks, thus raising their potential D-c. supply to the desired level.

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DON'T FORGET THAT YOU CAN ECONOMIZE BY USING G-E COPPER OXIDE RECTIFIERS ON ALL TANKS. THIS IS TRUE BECAUSE AT ANY ONE TIME YOU NEED OPERATE ONLY THE RECTIFIERS ON THE TANKS WHICH YOU ARE USING.

GENERAL ELECTRIC

lithopone min. 75 per cent, prussian blue max. 25 per cent. Seven other colored paints are provided for.

Vehicle: Volatile and non-volatile vary with color of paint.

General Requirements: Paint shall be ready mixed for brushing or spraying shall dry fast to a flat finish. Drying times are specified for each color. Weight per gallon varies with color.

3-75, Paint, Anti-Fouling

Composition: alcohol 30 gal.; gum shellac 69 lbs.; pine tar oil 5 gal.; turpentine 5 gal.; zinc oxide 69 lbs.; Indian red 69 lbs.; red oxide of mercury 24 lbs.

U. S. Navy Specifications

The following paints form a part of the contract specifications for vessels under construction, and are the instructions followed by the Navy in repainting vessels. All quantities (except where otherwise noted) are the number of pounds of each ingredient required in the manufacture of 100 gallons of paint.

3, Boot-Topping, Black

Composition: Zinc oxide, dry, 164; lampblack, dry, 73, raw linseed oil, 31; spar varnish, 435; paint drier, formula 86D, 222.

3A, Boot-Topping, Black

Composition: Manganese linoleate, 67; silica, dry, 84; lampblack, dry, 48; zinc oxide, dry, 138; coal tar, [2]2.5; formalin resin solution, [1]79; cuprous oxide, 109; mercuric oxide, 36.

4, Boot-Topping, Light Gray

Composition: Zinc oxide, dry, 390; lampblack, in oil, 1; ultramarine blue, in oil, 8; spar varnish, 669; petroleum spirits, 33; paint drier, formula 86L, 36.

5, Light Gray

Composition: Zinc oxide, dry, 289; titanium pigment, dry, 396; lampblack, in oil 21.5 ultramarine blue, in oil, 13; raw linseed oil, 538; petroleum spirits, 15; paint drier, formula 86L, 87.

6, Outside White

Composition: Titanium pigment, dry, 628; zinc oxide, dry, 280; raw linseed oil, 515; petroleum spirits, 29; ultramarine blue, in oil, [2]0.5; paint drier, formula 86L, 76.

9, Red Lead

Composition: Red lead, dry, 185; zinc oxide, dry, 86; venetian red, dry 355; spar varnish, 315; petroleum spirits, 210; paint drier, formula 86D, 79; aluminum stearate, 9⅜.

10, Light Gray, Smokestack

Composition: White lead, dry, 481; zinc oxide, dry, 188; litharge, dry, 34; lampblack, in oil, [2]2-6; ultramarine blue, in oil, 2-4; damar varnish, 194; kerosene, 337; paint drier, formula 86D, 55.

12, Green, Hospital Ships and Motor Boats

Composition: Zinc oxide, dry, 100; chrome green, dry, 300; chrome yellow, dry, 36; yellow ocher, dry, 75; lampblack, in oil, 60; spar varnish, 418; paint drier, formula 86D, 181.

14RC, Anticorrosive, Ship Bottom

Composition: Zinc oxide, dry, 186; venetian red, dry, 93; silica, dry, 93; rosin, grade WW, 145; coal-tar naphtha, 380; coal tar, 47.5; manganese linoleate, 129.

15RC, Antifouling, Ship Bottom

Composition: Zinc oxide, dry, 238; silica, dry, 78; magnesium silicate, dry, 72; cuprous oxide, 145; mercuric oxide, 45; rosin, grade WW, 248; coal-tar naphtha, 338; coal tar, 63; pine oil, 39.

15RX, Nontoxic, Ship Bottom

Composition: Zinc oxide, dry, 212; silica, dry, 82; magnesium silicate, dry, 83; indian red, dry, 160; rosin, 200; coal-tar naphtha, 296; coal tar, 133; pine oil, 78.

16, Copper Paint for Bottoms of Vessels

Composition: Zinc oxide, dry, 165; indian red, dry, 165; cuprous oxide, 75; gum shellac, 162; alcohol, 500; pine oil, 90.

26, Metallic Brown for Portable Water Tanks

Composition: Metallic brown, dry, 397; indian red, dry, 156; zinc oxide, dry, 79; silica, 78; mixing varnish, 472; paint drier, formula 86D, 109.

26A, Mixing Varnish for Portable Fresh Water Tank Paint

Composition: Modified phenolic resin (amberol No. 226 or equal), 105; raw tung oil, 348; petroleum spirits, 405; cobalt drier, 8; paint drier, formula 86D, 8.

80, Varnish, Phenolic Type

Composition: Phenolic resin, 110; tung oil, raw, 279; coal-tar naphtha, water white, 269; xylene, 116; kerosene, 94; lead manganese drier, formula 86D, 11.5; cobalt drier, formula 26B, 11.5.

83, Inside White for Submarines

Composition: Titanium pigment, dry, 462; zinc oxide, dry, 146; raw linseed oil, 93; varnish, formula 28B, 451;

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[1] *Gallons.*

[2] *Vary color pigments as required to maintain standard color and consistency.*

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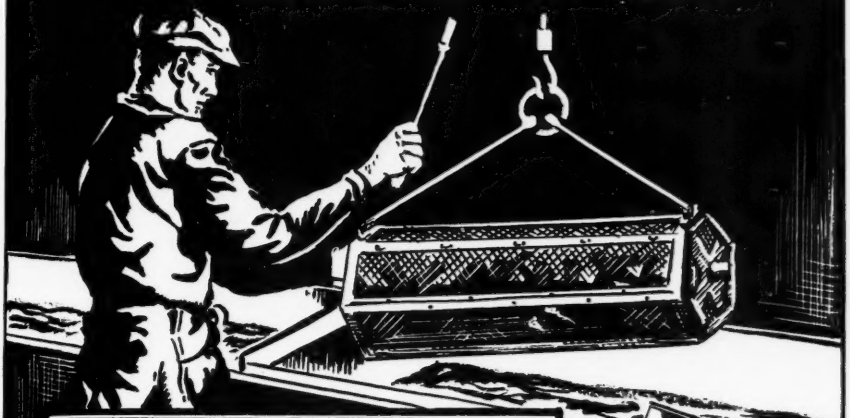

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damar varnish, 25; petroleum spirits, 71; paint drier, formula 86L, 13; ultramarine blue, in oil, 0.5.

84, Zinc Chromate Primer

Composition: Zinc chromate, dry, 565; magnesium-silicate, 65; varnish, formula 80, 653.

85, Spar Varnish

Composition: Ester gum, 87.5; rosin, grade WW, 25; lead rosinate, 25; raw tung oil, 109; varnish oil, 218; cobalt acetate, 0.75; petroleum spirits, 194; turpentine, 105; cobalt drier, formula 26B, 37.5; lead (naphthenate) drier, 45.

The Navy Department also makes use of the following Federal Specifications:

TT-P-22a	**TT-P-56**	**TT-E-506a**
TT-P-35a	**TT-P-81**	**TT-P-641**
TT-P-51a	**TT-P-101a**	

U. S. Maritime Commission

I, Metallic Brown (Semi-Gloss)

Pigment: 54-56 per cent, consisting of metallic brown 55-57 per cent, indian red 21-23 per cent, zinc oxide 10-12 per cent, silica 10-12 per cent.

Vehicle: 46-44 per cent, consisting of mixing varnish (Navy formula 26-A) 80-82 per cent, thinner and drier 18-20 per cent.

General Requirements: Weight per gal.: 13 lbs. Dry hard: 7 hours without brush marks. Water max. 0.5 per cent.

VI, Pea Green (Egg-Shell)

Pigment: 58-60 per cent, consisting of zinc oxide 59-61 per cent, titanium-barium pigment 29-31 per cent, tinting and siliceous pigments 9-11 per cent.

Vehicle: 42-40 per cent, consisting of linseed oil 39-41 per cent, spar varnish 34-36 per cent, thinner and drier 24-26 per cent.

General Requirements: Water max. 0.5 per cent. Dry hard: 7 hours without brush marks.

VII, Buff (Gloss)

Pigment: 54-56 per cent, consisting of zinc oxide 59-61 per cent, titanium-barium pigment 29-31 per cent, tinting and siliceous pigments 9-11 per cent.

Vehicle: 46-44 per cent, consisting of linseed oil 39-41 per cent, spar varnish 34-36 per cent, thinner and drier 14-16 per cent.

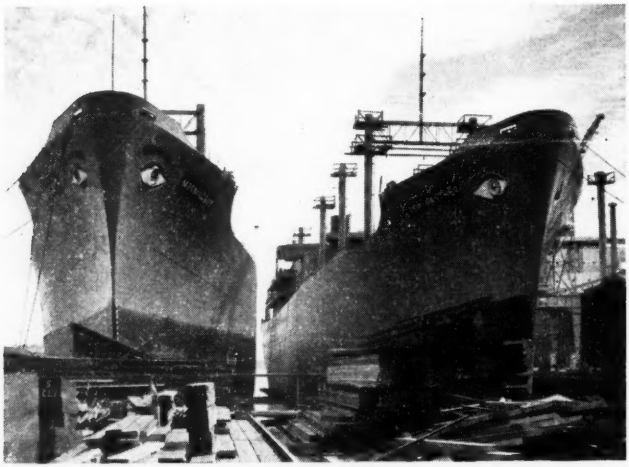
General Requirements: Water max. 0.5 per cent. Dry hard: 7 hours without brush marks.

XV, White and Tints (Gloss) (Synthetic)

Pigment: 34-36 per cent, consisting of titanium dioxide 49-51 per cent, zinc oxide 24-26 per cent, antimony oxide 24-26 per cent.

Vehicle: 66-64 per cent, consisting of glyceryl phthalate resin (fatty acid or oil modified type) 49-51 per cent, thinner and drier 49-51 per cent.

General Requirements: set to touch min. 30 minutes and max. 2 hours; hard 7 hours without brush marks. Flash point (tag) 85 deg. F. Flexibility: no cracking when brushed film is baked 6 hours at 160 deg. F. on tin panel and bent over ⅛-in. rod after chilling to 32 deg. F. Water resistance: 18 hours. Stability: remain stable and homogeneous after reduction with 10-15 parts of mineral spirits. Working properties: for brushing or spraying. Water: max. 0.5 per cent.



Eyes painted on their bows for good luck, the freighters Mormacsum and Sea Panther have been launched at Oakland, Calif. U. S. Maritime Commission specification finishes will help these boats remain serviceable as possible naval auxiliaries.

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XVI, White and Tints (Gloss)

Pigment: 59-61 per cent, consisting of zinc oxide 29-31 per cent, titanium-barium pigment 64-66 per cent, titanium dioxide 4-6 per cent.

Vehicle: 41-39 per cent, consisting of linseed oil 49-51 per cent, spar varnish 34-36 per cent, thinner and drier 14-16 per cent.

General Requirements: Dry hard: 7 hours without brush marks. Water max. 0.5 per cent.

XVII, Dark Gray (Gloss)

Pigment: 54-56 per cent, consisting of zinc oxide 59-61 per cent, titanium-barium pigment 29-31 per cent, tinting and siliceous pigments 9-11 per cent.

Vehicle: 46-44 per cent, consisting of linseed oil 49-51 per cent, spar varnish 34-36 per cent, thinner and drier 14-16 per cent.

General Requirements: Dry hard: 7 hours without brush marks. Water max. 0.5 per cent.

XVIII, Light Gray (Gloss)
Same as XVII—Dark Gray (Gloss)
XXI-B, Modified Red Lead

Pigment: 67-69 per cent, consisting of red lead (dry 97 per cent grade) 69-71 per cent, indian red (98 per cent Fe_2O_3 bright red) 4-6 per cent, zinc oxide 4-6 per cent, siliceous pigments 19-21 per cent.

Vehicle: 33-31 per cent, consisting of linseed oil min. 90 per cent, thinner and drier balance.

General Requirements: Settling: remain soft 6 months after delivery. Dry firm: 18 hours without brush marks. Coarse particles and skins: max. 1.0 per cent (on pig. wt.) on 325 mesh. Water max. 0.5 per cent.

XLI, Smokestack Paints—Heat Resisting, Durable of Any Color

General Requirements: Dry hard 7 hours without brush marks. Water max. 0.5 per cent.

XXIII-A, Deep Tank Coatings, Iron Oxide-Zinc Chromate Primer (Varnish Vehicle)

Pigment: 50-52 per cent, consisting of indian red 34-36 per cent, zinc yellow 39-41 per cent, zinc oxide 4-6 per cent, diatomaceous silica 9-11 per cent, magnesium silicate 9-11 per cent.

Vehicle: 50-48 per cent, consisting of a 33-gal. varnish. Non-volatile min. 55 per cent by weight (Chinawood oil min. 85 per cent, linseed oil max. 15 per cent). Resin: pure phenolic. Volatile thinner (xylol min. 10 per cent) free from toxic hydrocarbons; Viscosity: between C and E., Gardner. Toughness: pass 140 per cent Kauri reduction test. Water immersion on flow out films on tin panels: 96 hours cold water plus 6 hours in water at 77 deg. C. Dry on vertical smooth steel surface with no breaks or sagging to touch in max. 3½ hours, and hard in max. 18 hours.

General Requirements of Paint: Dry-to-touch max. 4 hours; dry hard max. 12 hours. Hiding power: 475 sq. ft. brushing. Surface suitable for application of aluminum finish coat. Flash point (tag) 85 deg. F. Flexibility: no cracking when brushed film is baked 6 hours at 160 deg. F. on tin panel and bent over ⅛-in. rod after chilling to 32 deg. F. in water. Water resistance: 18 hours. Stability: remain stable and homogeneous after reduction with 10-15 parts of mineral spirits. Working properties satisfactory for brushing and spraying.

XXXIX, Rust Preventative Coatings for Iron and Steel, Grade C, Heavy

Pigment: 20-25 per cent, consisting of sublimed blue lead, red lead, zinc yellow, basic lead chromate or any mixture thereof, 100 per cent.

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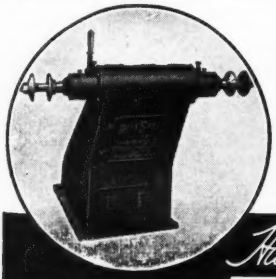

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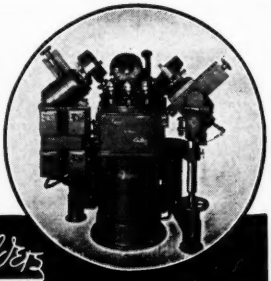

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THE KIRK & BLUM MFG. COMPANY

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Modern Gold Plating

By JOSEPH B. KUSHNER, Ch.E.
Metal Finishing Consultant

IN the olden days, if a heavy deposit of gold was to be electroplated, considerable labor was involved. The plater would first have to give the work a light coating of gold in a cyanide bath, then transfer the work to an acid bath for heavy deposition. From time to time the work would be removed from the acid bath to be scratch brushed to promote better adhesion. The current density used was quite low, in the neighborhood of three amperes per square foot, and if it were not for the fact that gold in acid solution, even though trivalent, has a high electrochemical equivalent (2.45 grams/amp. hr.) and a high cathodic efficiency, a plater's helper starting to plate a heavy deposit on a chalice would be a foreman by the time he had put on the proper amount of gold.

In recent years, however, the acid gold bath has become obsolescent; only a scattered handful of diehards use it any more and like the wooden cigar store Indian, it has practically vanished from the scene.

Today, it is possible to deposit really heavy layers of gold in just about one-third the time or even less (at the same current density) required with the old acid bath (the electrochemical equivalent of gold in a cyanide bath is about 7.35 grams per amp. hr.). Furthermore, it is possible to use much higher current densities now than formerly. As a matter of fact, the writer has succeeded in obtaining excellent, fine grained deposits of gold at current densities of 100 amperes per square foot and more, from certain types of cyanide gold baths. If we take the average cathode efficiency to be about 85 per cent (some rough measurements showed it to be around that), this means that it is possible to deposit over twenty ounces of gold on a square foot of surface in an hour. This is an interesting statistic but we do not know of anyone who would want to deposit that much gold on so small a surface in so short a time.

The fact that it seemed necessary to go through a complicated procedure to get an adherent, heavy gold deposit, gave the rolled gold and gold filled people a grand talking point. Incidentally, if we have not mentioned it before, gold filled stock consists of a thin sheet of nickel silver or some such base metal to which is

Part 6

A comprehensive discussion of the Bek process of gold deposition is presented herewith.

PHOTOGRAPHS BY THE AUTHOR

sweated on either side a layer of accurately alloyed carat gold. Rolled gold is made the same way but has the gold layer only on one side. In recent years both terms have come to be used interchangeably.

When it became known that heavy deposits of gold could be plated out from a cyanide solution, the rolled gold fraternity shouted from the housetops about the poor adherence of electroplated gold as compared with the adherence of gold that has been actually "sweated" on a base metal. The adherence of electrodeposited gold was definitely inferior, they said. This notion, happily for them, prevailed for a considerable period of time until one day in the twenties when one, Ernst Gideon Bek, a native of Pforzheim, Germany, hit upon the idea of heat treating an electroplated gold deposit so that some of the gold would diffuse into the base metal and vice versa, thus obtaining a gold plate that was firmly bonded to the base metal and killing once and for all the last feeble chirp of non-adherence.

This development which Bek first introduced in his home town and then later tried to market in the United States, did not attract much attention here until he sold the American rights to Weisberg & Greenwald,* Inc. In their laboratories, the process was further developed and improved.

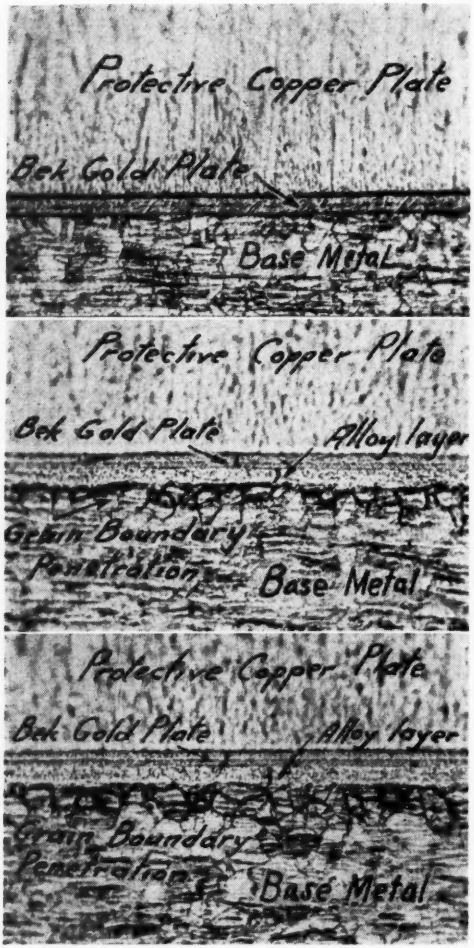
The fact that two metals in intimate contact will diffuse into one another on the application of sufficient heat over a sufficient period of time was a fact known for many years but Bek was the first to make practical use of this idea in gold plating. With his innovation, we can date the rise of modern gold plating.

The actual conditions for diffusion of one metal into another are: (1) The metals must be in intimate contact; (2) The interface must be clean; (3) The metals must form a solid solution; (4) The melting points of the two metals must not be too high or too far apart.

If one metal is plated on another they are in closest possible contact, and it only requires the application of some heat, providing the other factors are complied with, to produce the diffusion. In fact, in some cases practically no heat is required, as any plater will testify who has had the imprudence of plating gold directly

* Now known as Louis Weisberg.

DIFFUSION IN THE BEK PROCESS
GOLD ON NICKEL SILVER



Photomicrographs courtesy Dr. L. Weisberg

Fig. 13—(Above) Illustration showing a photomicrograph of a gold deposit before heat treatment.

Fig. 14—(Center) A view of the same deposit as shown above after heat treatment of one hour at 860 deg. F.

Fig. 15—(Below) This illustration shows the same deposit after heat treatment of two hours at 860 deg. F.

over zinc die castings or white metal castings without putting at least .0003 in. of copper or nickel between the gold and the casting. The imprudent one will plate the highly polished castings, obtain a beautiful gold color on them, lacquer them and send them post haste to the waiting customer, only to have the customer call up in a few days to reprimand him for putting on a "vanishing gold plate." For day by day, from the moment the casting is taken out of the plating bath, the gold deposit, unless it is a very heavy one—and you can rest assured that it is not—diffuses into alloys with the zinc or tin until it disappears like a boulder in a bog.

With metals less active and porous than these, such a process requires a considerable heat treatment and no available method of measurement will show any diffusion at room temperature, even though it does undoubtedly occur. In the case of gold, diffusion can occur at temperatures considerably below its melting point, which is 1,945 deg. F. Slow but steady diffusion takes place at temperatures as low as 400-500 deg. F.

The actual process of diffusion and alloying is clearly visible to the naked eye in the case of gold plated on silver, copper or nickel. If we heat treat a silver object that has been plated with a fairly heavy layer of gold, at about 800-900 deg. F. the color of the gold gradually changes from rich yellow to greenish yellow, then as the treatment continues, the color changes to an off-white. These

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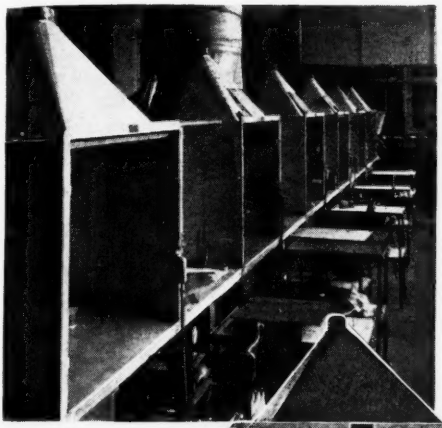

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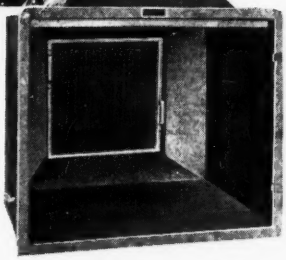

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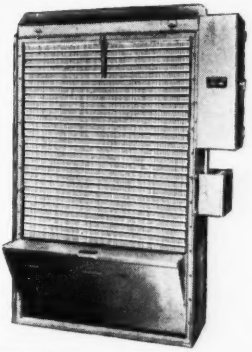

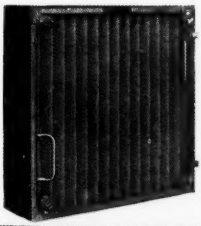

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changes are the same as would occur if we melted some gold with silver and gradually increased the silver content of the alloy.

Similarly, when gold is plated on copper and subsequently heat treated under the same conditions the color of the gold changes from yellow to pinkish to red, exactly the color sequence of a series of gold copper alloys with increasing copper content. In the case of gold plated on nickel, the color sequence as the heat treatment continues is from yellow to white.

Fig. 16—Sample lots of the workpieces are accurately weighed in the analytical balance shown here.

The photomicrographs shown in Figures 13, 14 and 15 give a fairly clear idea of the process. Figure 13 shows the Bek gold deposit, of yellow gold on a nickel silver base, backed up by a copper deposit for metallographic handling, before the heat treatment has taken place. The gold plate and the base metal are clearly visible as two distinct separate layers. Figure 14 shows what has occurred after one hour of heat treatment at 860 deg. F. Now a thin alloy layer can be seen in between the gold deposit and the base metal and the first signs of intergranular penetration are just beginning to become visible. Figure 14 shows what has happened after two hours at the same temperature. After this time interval, the alloy layer is somewhat thicker and the grain boundary penetration is much more noticeable.

The actual thickness of the diffusion layer is a complex function of a number of factors among which are temperature and time. If the temperature and other factors are held constant, the thickness of the diffusion layer varies approximately with the square root of the time of treatment, or mathematically speaking,

$$X = K\sqrt{T}$$

where X is the thickness of the diffusion layer, K is a constant and T is the time of heat treatment.

This means that if we have a diffusion layer one unit thick after, let us say, one hour, the layer will become twice as thick after four hours of heat treatment. The photomicrographs give a very rough illustration of this equation.

PROOF OF THE ALLOY NATURE OF THE HEAT TREATED DEPOSITS

The fact that true alloys are formed by this process can be proved not only by the microscope but by the eye and an acid test as well. As pointed out previously, the naked eye can discern very easily the color changes that occur and match them carat for carat against those of the solid gold alloys of the same composition (See Part V of this series). The

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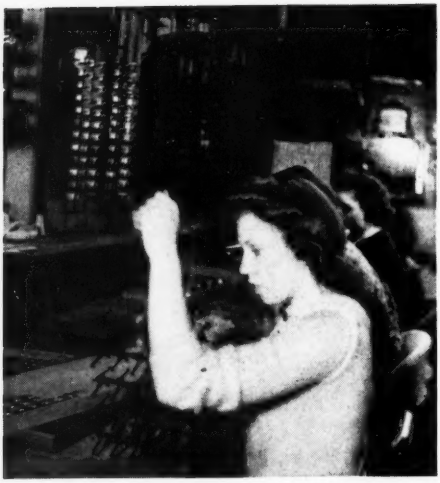


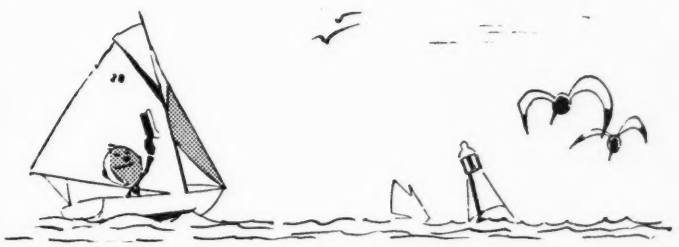
Fig. 17—The watch cases are placed on specially designed work holding racks.

other proof of actual alloying is this: By cautiously dissolving the base metal a shell of alloy gold remains which has a much lower over-all carat than that of the gold originally plated on. This is done by making a scratch on the surface of the plated object so that the cold, dilute nitric acid used can penetrate to the base metal. After a period of about a week (the reaction rate is slow with cold, dilute nitric) the base metal is completely dissolved out, leaving a sturdy shell of gold behind that can be bent and handled without breaking. This heat treated shell is not only heavier in weight and thicker than the original unheated deposit but it is much lower in carat, as an assay proves. The actual drop in carat may be as much as 6 to 8 carats.

If the same piece had not undergone a heat treatment prior to dissolving the base metal, the remaining shell would not only have been thinner but much more fragile and brittle. In fact, the shell of gold would be so brittle that it would crumble and flake and indeed the chances are that an entire undamaged shell could not be obtained at all. Anyone who has ever attempted to dissolve away the base metal from even a flat gold plated piece so as to keep the gold plate intact, can attest to the truth of this statement.

While pure gold can be deposited on the base metal and alloyed with it by the heat treatment to form a perfectly bonded alloy coating, the general practice is to deposit the gold as an alloy in the first place. This gives the process more flexibility in-

Fig. 18—Special care is exercised by the operator shown here to see that the work is made scrupulously clean. Note the glass carboys in the background containing stock gold solutions.



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asmuch as it makes it more simple to get a finished gold plate that will have the desired characteristics in the way of color, composition, hardness and other physical properties. It also tends to reduce the period of heat treatment required, as well as

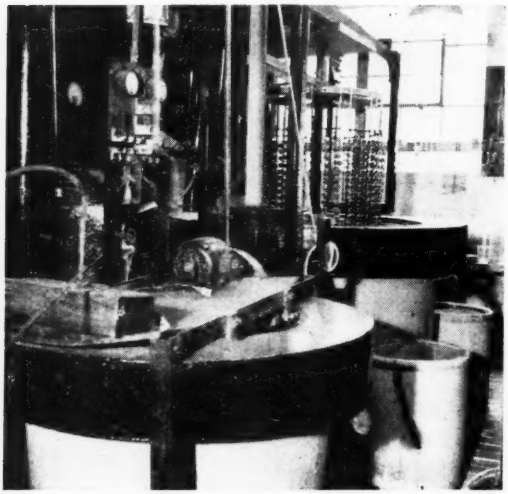

Fig. 19—The racked workpieces are placed in the glass lined steel tanks shown here. These tanks are provided with circular cathode bus bars and circular fume ducts.

permit a reduction in the effective diffusion temperature. These latter two points are quite important since prolonged heat treatment may cause a softening of the work, and high temperatures, excessive and unwanted grain growth.

In the early days of development, the procedure was to deposit high carat alloys, 20-22 carat in composition, the carat of which after a lengthy heat treatment would drop down to about 15 or so. Gold plating alloys of lower carat than 20 were not only difficult to deposit but almost impossible to control in order to obtain consistent, uniform results. However, recently the process of alloy plating has been improved to such an extent that it is now possible to plate out from the bath gold alloys of carats as low as 14 with a variation of less than ½ carat over a given series of runs.

BEK PROCESS CYCLE AT THE NEW HAVEN CLOCK COMPANY

It was the writer's good fortune to be able to visit the gold plating room of the New Haven Clock Co. not so long ago. Since this plant is one of the largest users of the Bek Process, we considered ourselves lucky indeed to be given permission from the management to take a few pictures of their procedure. These pictures form a sort of photographic flow sheet of the process, which is described here.

Sample lots of the work ready to be plated (in this instance, watch cases) are accurately weighed on an analytical balance as shown in Fig. 16. These samples are the controls or pilots of the given run. The load of work, including the controls, is now racked by the rack girls shown in Fig. 17 on special insulated racks and put through a cleaning operation illustrated in Fig. 18 after which they are placed in large (100-200 gallon) glass lined steel tanks containing the Bek gold plating solution as shown in Fig. 19. The electrolyte, which is of a special type, contains the salts of copper, nickel, and zinc as well as those of gold and a number of unspecified compounds. Gold anodes are not used in the solution because gold anodes tend to dissolve at a non-uniform rate in the plating bath. If the

gold anodes dissolved, the gold content of the bath could not be held at a constant value, which is necessary to the proper operation of the process. Furthermore, the use of insoluble anodes reduces the gold inventory and prevents possible loss due to theft.

The tanks are heated under thermostatic control so that the temperature of the plating solutions does not vary more than one-half a degree. The cathode bus bar consists of a circular ring on which the racks are mounted as shown in Fig. 19. The ring rotates a fixed number of revolutions in a clockwise direction then reverses itself and moves counterclockwise for the same number of turns.

The purpose of this rhythmic rotation is to make sure that every case receives an equal amount of gold or rather, that the deposits are uniformly distributed over the load, for if the pilot cases get less gold than the balance of the load, the work may be over-plated and gold wasted. If the load receives a heavier deposit than the pilot, then too little gold will be put on. The rotary motion tends to keep the deposition of gold uniform by breaking up stratification (See Part IV of this series) and the reversals prevent the leading edges from getting heavier deposits than the other portions of the load.

After a definite period of plating under controlled conditions the run is stopped and the racks are removed as shown in Fig. 20 and rinsed. The cases are then taken off the racks and dipped in a borax solution which acts as a flux, and placed in the heat treating furnace for a fixed period of time at a temperature of 850-950 deg. F. A view of the electric heat treating furnace can be seen in Fig. 21.

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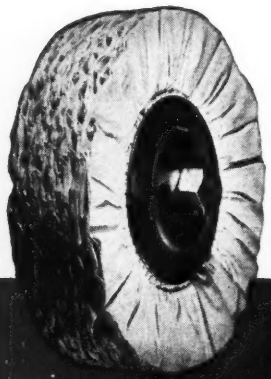

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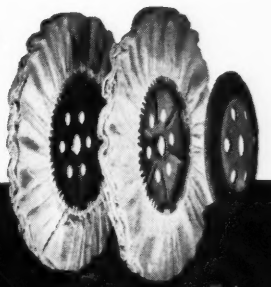

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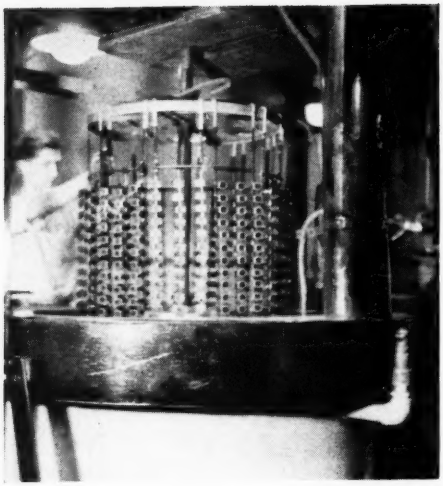

Fig. 20—The operator can be seen removing a rack of work from the plating tank. Rubber plugs are placed in each case to prevent the gold from depositing on the inside of the case.

•

At this point, the sample watchcases are reweighed to check on the total weight of gold that has been deposited, to make sure the proper amount of gold has been put on all the watchcases according to the computed operating conditions.

The work is now tumbled or buffed to a high finish, after which it is reracked, cleaned and given a gold flash by the operator shown in Fig. 22. The work is given the special flashing to correct slight variations in the color of the deposits. The work is now dried, taken off the racks and placed

The furnace used by the New Haven Clock Co. is an electric, controlled atmosphere type, thermostatically governed. The controlled reducing atmosphere prevents the formation of heat tarnish and scale on the work greatly minimizing cleaning and buffing labor.

After removal from the heat treating furnace the work is reracked and cleaned and given another turn in the Bek plating bath for a second fixed period of time. The work is then removed from the racks and put through a second heat treatment. The repeat plating and double heat treatment is not absolutely necessary (many plants employing the process use only one). According to the metallurgist in charge of the process at this plant, repeating of the process seems to give better results inasmuch as the work does not have to stay too long in the furnace. In one particular plant known to the writer, the work is kept in the furnace for nine consecutive hours, but in this special case the base metal is practically pure nickel.

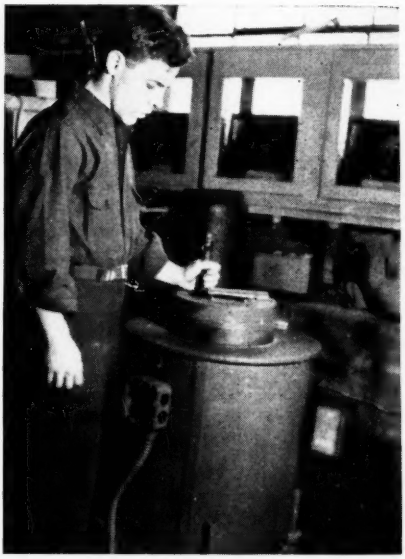

Fig. 21—Each batch of work is treated in this specially designed heat treating furnace.

in the stock room. This gives a general idea of the Bek Gold Plating Process.

CORROSION RESISTANCE

As pointed out many times before in this series and in other articles by the writer, gold is an extremely corrosion resistant metal; but the moment it is put in contact with a base metal, you set a pot of trouble brewing, unless the gold completely covers the base metal with an impervious coating. This means no pin-holes, hair cracks and a minimum of porosity. The moment moisture reaches the interface or point of contact between the gold and the base metal a tiny electric battery is set up with the gold acting as a cathode, at the expense of the base metal which rapidly dissolves and corrodes.

If we are interested in putting a gold plate on the work that is not to tarnish in a few days, we should avoid the cracks, holes and pores of ordinary flash deposits. Pinholes are avoided by the use of clean filtered solutions of high pH in which hydrogen evolution is kept at a minimum. Pores are reduced to a neglible amount by increasing the thickness of the deposit (porosity varies roughly inversely with the thickness of the deposit) and cracks are avoided by plating under conditions that do not set up too high a stress in the deposit.

The Bek Process meets all these specifications. Futhermore, there can be no doubt that the heat treatment tends to relieve strains in the deposit if any exist since the gold is partially annealed. The heat also tends to close up any pores present in the deposit by permitting a sufficient flow of metal to produce this result.

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Fig. 22—After heat treatment, the workpieces are subjected to a flash plating solution, as shown in this illustration.

Therefore, corrosion in an unlacquered gold deposit can be reduced to the vanishing point. At this point, we might point out that rolled gold does not always completely protect the base metal inasmuch as the edges are "raw."

WEAR RESISTANCE

The next standpoint from which to consider the Bek Process is that of wear resistance. In Part V of this series I mentioned the fact that the controlling factor in the wear resistance of a gold plate is hardness. The process of rolling, in the manufacture of gold filled stock, work hardens the gold considerably, whereas the heat treatment in the Bek Process anneals the gold and softens it.

It must not be forgotten, however, that electroplated metals always tend to be harder than the same metals in solid form. Thus, for example, platinum ordinarily a fairly soft metal in massive form, when electroplated assumes a Brinell Hardness of over 400. The harder metals in the plated alloy and in the base metal, tend to, in the process of diffusion that occur during the heat treatment, counteract any softening effect the annealing of the gold may have. Additional hardness may be further obtained by tumbling or burnishing the deposit.

In the original Bek Process, the starting carat of the plated gold alloy was about 22 which is nominally

Fig. 23—A trained chemist carefully controls the contents of the plating solutions.

quite soft. Later it was pointed out that the distribution of the alloy after the heat treatment was non-uniform, starting as a 12 or perhaps 13 carat alloy at the interface and gradually becoming higher in carat or softer as the outer layers were reached; in fact, the top-most layers were practically the original carat (22) and further softened because of the annealing effect. This phenomena is illustrated in the drawing designated as Fig. 24. This was true, of course, and was one of the reasons electroplated gold did not seem to stand up as well in use as rolled gold. Not only were the plated layers thinner as explained in Part V but they were softer as well and, in contact with the skin which even though it is very soft, and hardly what can be considered abrasive, failed to give the service of rolled gold plate.

Recently, however, this fault has been largely overcome by the deposition of lower carat alloys and increasing the time of heat treatment. With the newer methods of procedure, the hardness of the plated gold has been greatly increased. In fact, it is even harder than a rolled gold alloy of the same composition. In recent wear tests made in one plant between the relative wear resistance of rolled gold and plated gold of the same carat, the abrading machine indicated that the Bek Process electroplated finish had a wear resistance about 1½ times greater than that of the rolled gold.

The Bek Process is one of the few scientifically controlled, really modern gold plating procedures known to the author. The operation of the process requires advanced methods, constant careful chemical as well as metallurgical control and though it has not been so widely adopted for

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heavy gold plating as it deserves to be, it is the handwriting on the wall for hit and miss gold platers. The Bek Process definitely indicates the

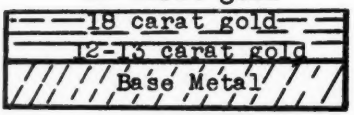

Fig. 24—Drawing showing non-uniformity of the gold deposit in the original Bek Process.

trend toward controlled specification gold plating and the rise of metallography as a sister guardian with electrochemistry, of the gold plating bath.

The process can be carried out in gold plating barrels also, but this phase will be taken up in a later article on barrel gold plating.

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ACKNOWLEDGEMENT

The writer wishes to gratefully acknowledge the helpful cooperation shown him by Dr. Louis Weisberg and J. C. Sullivan of The New Haven Clock Co. with whose permission we have been able to take and reproduce the photographs shown in this article.

Westinghouse Drying Lamp Booklet. How to apply radiant heat lamps to industrial drying, baking, and heating tasks is told in a 12-page illustrated booklet now being issued by the Westinghouse Lamp Division, Bloomfield, New Jersey.

The fundamentals of radiant heat are presented in the first section of this publication, followed by four pages of photographs showing typical drying lamp installations.

Application data, with formulas for calculating the number of kilowatts required to produce the necessary amount of heat, and recommended spacing of the lamps are included. All types and sizes of Westinghouse drying lamps are listed and described.

Copy of this booklet may be obtained free upon request.

Binks Industrial Spray Finishing System. Binks Manufacturing Company, 3114-40 Carroll Ave., Chicago, Ill., has announced the publication of a 92-page complete industrial catalog, covering all types of spray painting and finishing equipment.

This catalog is loose leaf in form and is handsomely bound in a red, laminated cellophane cover.

The catalog gives complete engineering data and specifications, together with prices on spray booths, spray guns, oil and water extractors, air supply and air exhaust systems, portable painting outfits and automatic finishing equipment, and all that pertains thereto.

A copy of this valuable catalog will be sent free of charge to anyone addressing the sales promotion division of Binks Manufacturing Company on his company letterhead.

What Users Say About Wheelabrator Performance. The American Foundry Equipment Co., 555 S. Byrkit St., Mishawaka, Ind., is now issuing an attractively colored, 72-page testimonial book

entitled "What Users Say About Wheelabrator Performance."

Some of the many users of Wheelabrator airless abrasive blast cleaning equipment were asked for their comments on its performance. Letters from 64 users who replied are included in the book.

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Pictures and descriptions of the complete American line, a list of American sales representatives and a view of the plant are also included.

A copy of this book may be obtained by writing directly to the manufacturer.

"The Story of Modern Industrial Weighing" is the title of a broadside which is now being issued by The Exact Weight Scale Co., Columbus, Ohio, illustrating and describing numerous types of Exact Weight Scales for use in checkweighing, counting, balancing, compounding, testing, and handweighing. Photographs showing the applications of Exact Weight Scales to various industries are included. Copy of broadside free upon request.

Reznor Gas Fired Suspended Unit Heaters. The new line of Reznor gas fired unit heaters, which includes fan type, blower type, and duct type units, is described in Catalog U41 recently issued by the Reznor Manufacturing Co., 163 James St., Mercer, Pa. Each type of unit is available in five different capacities ranging from an input of 55,000 b.t.u. per hour to an input of 200,000 b.t.u. per hour.

Catalog U41 comprises 12 pages, 8½ by 11., and is fully illustrated with drawings and photographs which show the important construction features of the various types of units. It is punched with standard three hole punching for easy filing. Copies of the catalog will be sent free upon request.

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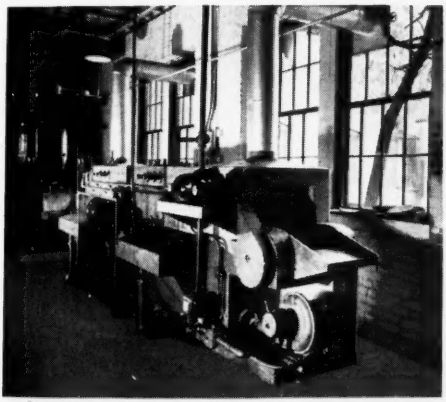

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Solvent Degreasing and Health

By N. E. PROMISEL
Industrial Consultant, Brookline, Massachusetts

IN an article by the author on "Health Hazards in the Finishing of Metals," published in the December, 1940, issue of this periodical, the subject of solvents used in degreasing operations was discussed. Because of queries and comments resulting therefrom, it has seemed advisable to go into this subject at greater length, especially with regard to trichlorethylene in degreasing machines. (The other solvents are used to such a relatively slight extent in this process that they will not be considered. Furthermore, trichlorethylene is recommended as being one of the least toxic of the group of solvents.) This article is, therefore, an attempt to depict, from an engineering-hygiene point of view, the status of metal degreasing as popularly practiced today and to show the relation of modern equipment design for safety in degreasing processes.

For the sake of completeness and for better understanding of the recommendations to be given for design and practice, it is desirable to review the properties of trichlorethylene. The solvent is a colorless liquid, having an extremely slight mutual solubility with water; boiling, when pure, at 188.1 deg. F.; and having an odor similar to carbon tetrachloride. The liquid is about 1.5 times as heavy as water, and the vapor is about 4.5 times as heavy as air. Its low specific heat and latent heat of vaporization make it very suitable for use in the vapor phase from the point of view of economical heat consump-

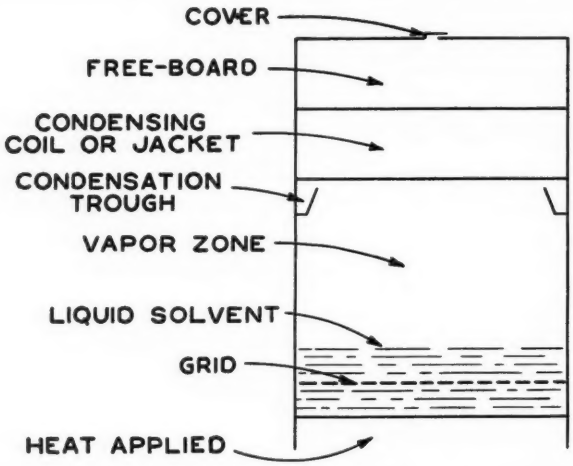

Fig. 1 — A diagrammatical sketch illustrating the general principle of solvent degreasing machine operation.

tion. It is rated by the Underwriters' Laboratory as "non-inflammable and non-explosive." The rapidity with which it dissolves animal, vegetable and mineral oils, greases, fats and waxes and some other organic materials is of course well known and is responsible for its great popularity in metal degreasing after various machine operations, polishing and buffing, oil quenching, usage involving lubrication, and so on.

Although essentially a stable material, trichlorethylene would suffer some decomposition in common industrial usage if it were not properly treated. Decomposition may be due to the action of air at elevated temperatures, of water, of open flames or very hot surfaces like heating coils, and of light. Some of these possibilities are increased if certain impurities find their way into the solvent. Thus, if aluminum is present, the formation of hydrochloric acid results in the formation of aluminum chloride, which substance accelerates further decomposition of the solvent, so that special care is needed in cleaning aluminum. For such reasons, reliable manufacturers of this solvent in the first place prepare the material in a very pure state, then stabilize it in both the liquid and vapor phases to inhibit many of the actions of the decomposing agents mentioned above, and in the third place, specify, together with the equipment manufacturers, the proper operation of the degreasing process.

Purification, such that trichlorethylene is now available with a boiling range within 2.7 deg. F., means (1) that undesirable and more dangerous (toxic and flammable) substances have been removed; (2) that the vapor level in the degreaser may

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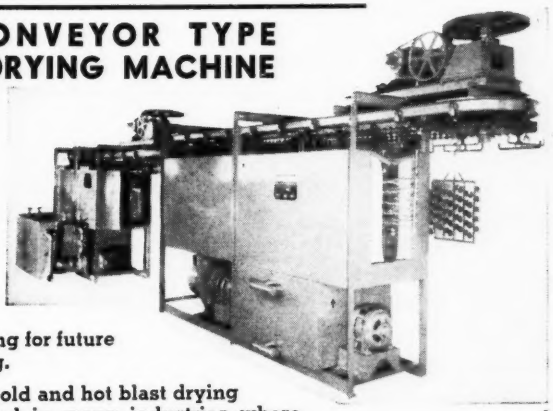

• The wash and rinse units of this machine are shown at the rear, in the illustration. Here, the racked metal parts are cleaned for plating or lacquering.

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be more easily and more closely controlled, resulting in less danger of vapors escaping into the room; (3) that the efficiency of distillation is increased; and (4) that when in addition a proper stabilizer is present, there is a minimum possibility of decomposition. The stabilization, however, does not prevent decomposition due to contact with direct flames or red hot surfaces so that even stabilized trichlorethylene should not be heated above about 250 deg. F., and steam, if used, should not be in excess of 25 pounds gauge pressure. For safety's sake, too, the degreaser should not be within 50 ft. of large high temperature surfaces, unexhausted open flames, welding operations, and so on. Although recent tests indicate that the smoking of cigars or cigarettes in the neighborhood does not cause any appreciable decomposition of trichlorethylene, most suppliers of solvents and degreasing equipment recommend that no smoking be permitted.

The modern degreasing machine is the result of many years of research and experimentation, in the course of which the factors of simplicity, economy, and safety have been considered.

From the equipment point of view, one of the first considerations, from a constructive standpoint, was the material to be used in the fabrication of the unit. The two factors of importance are the possible corrosion of the equipment and the contamination of the solvent. The manufacturers, in general, favor tanks of zinc-coated iron and steel prepared either by hot-dipping, in the case of small units, or by metalizing in the case of large units. The use of 18-8 stainless - clad steel is increasing where improved corrosion resistance is needed. For other parts of equipment, tin, brasses, bronzes, copper and lead are satisfactory, provided the solvent is properly used as described above.

The next point to be considered is the engineering design of the degreaser. It may

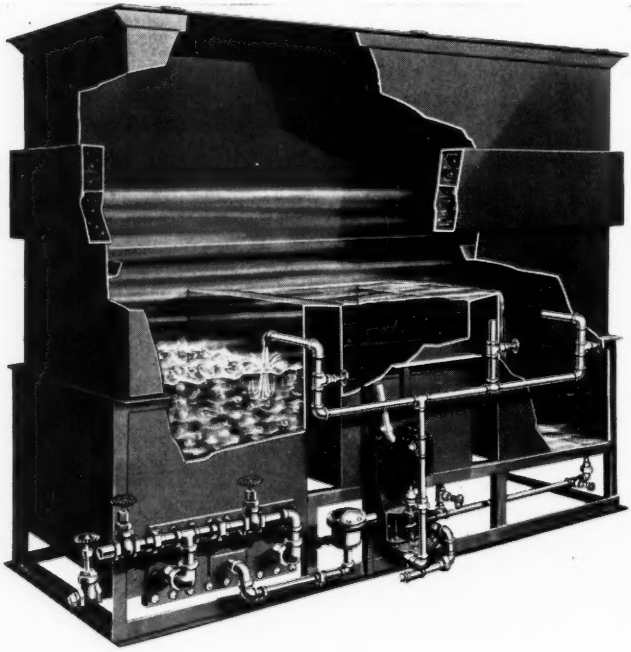

Fig. 2 — This cutaway view of a hand or hoist operated three-deep, liquid-immersion degreaser shows the general construction, solvent levels, and vapor line.

be well to digress a moment to review the types of solvent degreasing systems available. First, there is, of course, the possibility of using the solvent as a cold washing medium in an open tank. Needless to say, this is a most unsatisfactory method because of early contamination of the solvent with grease and oils which are then left on the work being cleaned, and because of the great loss in solvent, making the process expensive. These considerations hold, of course, whether the solvent is trichlorethylene, carbon tetrachloride, or what-not.

The next type of solvent degreasing brings us to the general principle of degreasing machines, diagrammatically illustrated in Figure 1.

In its simplest and barest details, a boiling solvent is used. The vapors rising as a result of this are condensed near the top of the tank by a coil or jacket, through which water is circulating, and are returned to the bottom of the tank, so that the same solvent is used over and over again. Drains are available for emptying the tank of dirty solvent and sludge and of slushing liquids used to wash out the tank periodically. The simplest metal washing process consists of merely submerging the work in the boiling solvent. Although this method eliminates to a great extent the loss of solvent vapor, the objection of early contamination of the solvent itself still holds.

The latter point led to the use of vapor degreasing. The immersion into the hot solvent vapor of the cold dirty work causes the condensation on it of the pure solvent (since the contaminations in the solvent do not rise with the vapor). The condensed pure solvent dissolves the greasy or oily dirt on the work and washes it back into the tank. When the work has reached the temperature of the vapors, the condensation ceases and

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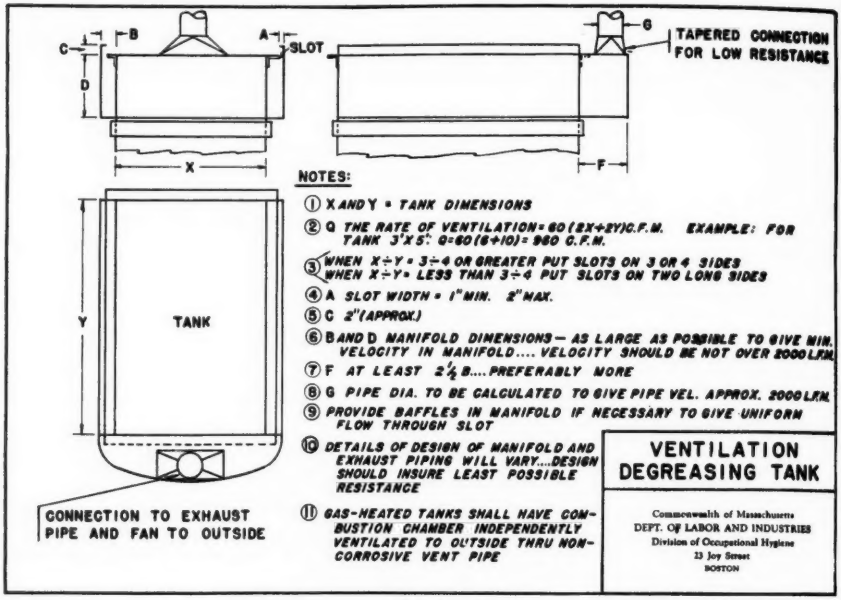
if the work is removed slowly enough from the tank to avoid dragging out too much of the vapor, it emerges dry and clean. Insoluble dirt is generally not removed in simple vapor degreasing, therefore, variations have


B
A
C
SLOT
D
G
TAPERED CONNECTION FOR LOW RESISTANCE
X
F
Y
TANK
NOTES:
① X AND Y = TANK DIMENSIONS
② Q THE RATE OF VENTILATION = 60 (2X+2Y) C.F.M. EXAMPLE: FOR TANK 3'X5': Q=60(6+10)=960 C.F.M.
③ WHEN X÷Y = 3÷4 OR GREATER PUT SLOTS ON 3 OR 4 SIDES WHEN X÷Y = LESS THAN 3÷4 PUT SLOTS ON TWO LONG SIDES
④ A SLOT WIDTH = 1" MIN. 2" MAX.
⑤ C 2" (APPROX.)
⑥ B AND D MANIFOLD DIMENSIONS — AS LARGE AS POSSIBLE TO GIVE MIN. VELOCITY IN MANIFOLD.... VELOCITY SHOULD BE NOT OVER 2000 L.F.M.
⑦ F AT LEAST 2½ B.... PREFERABLY MORE
⑧ G PIPE DIA. TO BE CALCULATED TO GIVE PIPE VEL. APPROX. 2000 L.F.M.
⑨ PROVIDE BAFFLES IN MANIFOLD IF NECESSARY TO GIVE UNIFORM FLOW THROUGH SLOT
⑩ DETAILS OF DESIGN OF MANIFOLD AND EXHAUST PIPING WILL VARY.... DESIGN SHOULD INSURE LEAST POSSIBLE RESISTANCE
⑪ GAS-HEATED TANKS SHALL HAVE COMBUSTION CHAMBER INDEPENDENTLY VENTILATED TO OUTSIDE THRU NON-CORROSIVE VENT PIPE
CONNECTION TO EXHAUST PIPE AND FAN TO OUTSIDE
VENTILATION DEGREASING TANK
Commonwealth of Massachusetts
DEPT. OF LABOR AND INDUSTRIES
Division of Occupational Hygiene
23 Joy Street
BOSTON

(Drawing Courtesy Div. Ind. Hygiene, N. Y. Labor Dept.)

Fig. 3—The exhaust system for solvent degreasers illustrated herewith is recommended by the Division of Industrial Hygiene of the New York Labor Department.

been introduced to satisfy more severe requirements. Thus, besides this simple vapor degreaser, there are the two-dip and three-dip degreasers consisting of a section with boiling solvent for washing the dirt (especially non-soluble dirt) more effectively and for light gauge work which heats up too rapidly in the vapor, followed by a section with clean cold solvent for rinsing and cooling the work prior to its final washing in the pure vapor. Figure 2 shows a cut-away view of a hand or hoist operated three-dip, liquid - immersion degreaser. Where neither boiling solvent nor vapor will remove stubborn dirt, there is a slushing attachment, whereby some of the clean solvent in the tank is pumped through a flexible hose to a nozzle, the spray from which is concentrated on the work suspended in the tank.

The above describes only the principles of degreasing. It is in the details of design, installation and operation that lies the safety and lack of health hazard connected with solvent degreasing. These details have been carefully considered by r e l i a b l e equipment and solvent manufacturers, who have established the practice we can now describe. Unfortunately they have been too often neglected by those constructing "homemade" machines.

Heating — Heating is done either with steam, gas or electricity. Steam is by far the most popular and the one that requires the least precautions. It has already been stated that the maximum steam pressure is limited to 25 pounds gauge to prevent decomposition of the trichlorethylene due to excessive heating. In fact, 15 pounds is the pressure recommended in most case. For the same reason, gas or electrically heated units have suitable thermostats located in the heated liquid chambers, set below 260 deg. F. and preferably not over 250 deg. F. In addition, gas-fired units are equipped with a flue from the combustion chamber to the outside, of adequate capacity, acid-proofed, with means to prevent back-draft, and insulated for at least one foot above the top of the machine. The repair of such vent stacks is often neglected by the user, which is a disadvantage of gas heating. With respect to electric-heating, the danger of exposing solvent to the heater coils has been mentioned.

Drains, clean-out doors and distillation — The cleaning of degreasing units is of great importance. The accumulated grease and dirt are removed, otherwise the heat necessary to vaporize the solvent becomes excessive, the maximum temperature normally permitted may be exceeded, difficulty may be experienced in securing sufficient pure vapors and abnormal chemical reactions may set in. Furthermore, accumulated water and impurities must be removed to prevent decomposition of the solvent or corrosion of the equipment. The solvent is therefore periodically distilled. This is done either in the degreaser itself, by using a condensation trough below the vapor cooling

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region, or, in the case of large degreasers where interruption in production is not desired, in separate stills. For removing the residual sludge, dirt and wash waters, suitable clean-out doors are installed in each compartment of the degreaser and also in the separate stills if any are used. When cleaning the degreasing tank, it should be remembered that the concentration of vapor may be high even if only a little solvent remains in the tank and the workmen should remove all the solvent and air out the tank thoroughly before climbing or bending into it. In emergencies, hose masks or air line respirators should be used.

Condensers — Cooled water, circulating through either a water jacket or a series of coils, is used to form a condensing region which should condense all the vapor formed at any time from the solvent (i.e. at maximum heat input with unit idle). In the case of a degreaser with proper balance between heating and condensing system, practically no vapor escapes, at least when the degreaser is idle. At the same time, the condensing zone serves to restore quickly the original vapor level to its desirable sharp clear line of demarcation after it has been disturbed by work going in or out, and this again reduces the amount of solvent vapor escaping into the air. The water used should not be too cold, that is, not below the dew point, to avoid condensing water from the air. Such water, aside from its effects described above, increases the corrosion of existing condenser tubes, which, having been degreased, are particularly susceptible to corrosion. A temperature from 90 deg. F. to 115 deg. F. for the water is recommended. As a further precaution against insufficient cooling, a thermostat is inserted one inch above the top of the condensing region but definitely below the top of the tank. This thermostat should, of course, be connected to shut off the heat supply if the vapors rise above a safe level. The condensing unit itself is placed at such a height that the minimum vertical distance from the normal vapor level (no work going through) to the lowest point at which vapors can escape from the unit is at lease one-half the width of the unit. This vertical distance is referred to as "freeboard" or "side-board."

Water separators—Except in the case of small units, degreasers should be equipped with water separators, to remove the water from the condensed vapor. If the cooling water is at the temperature recommended above, namely, 90 deg. to 115 deg. F., a pre-cooler or vapor trap set before the separator will insure the complete removal of undissolved water without the loss of vapors.

Exhaust systems and general ventilation—It is generally agreed that the maximum concentration of trichlorethylene vapors that should be permitted in a room is about 200 parts per million. It is possible and entirely practical to operate a degreaser so that this figure is not exceeded, usually without requiring a special exhaust system, although in certain places, for example where the degreased parts are stored and near some solvent sprayers, the concentration may rise. The results of an investigation conducted by the New York State Division of Industrial Hygiene indicate that when degreasing tanks are installed in rooms sufficiently large, over 20,000 cu. ft., the natural dilution of the vapors due to general ventilation in the room generally keeps the concentration of the solvent vapor down to a safe level even in the breathing zone, if no disturbing drafts are present. In smaller

rooms, or with improper equipment or operation, increased general ventilation and the use of a local exhaust system may be advisable. Some manufacturers feel that no unit with a horizontal cross-sectional area over 600 sq. in. should be installed in rooms of less than 4000 cu. ft. unless exhaust equipment is provided. Such an exhaust system, recommended by the Division of Industrial Hygiene of the New York Labor Department is shown in Fig. 3. This recommendation takes into account the physical properties of the solvent, increased loss of solvent, control of vapor and other engineering details.

It is important to emphasize that the use of an exhaust system or increased general ventilation should not be considered as substitute for careless operation of a degreaser. It is far better and certainly more economical to operate in such a way that local exhaust systems are not necessary. In fact, there is some very recent evidence questioning the advantage of exhaust systems under certain conditions.

This completes the description of the more important details of equipment used in degreasing units and the safety features that have been introduced. There remains the discussion of installations precautions and good operating practice.

Installation—Several features have already been mentioned in this connection. The unit should not be installed near open flames (unless their combustion products are well exhausted), near very hot surfaces, welding operations, and so on. It is very important that the unit be placed where it will be free from drafts. The latter disturb the nor-

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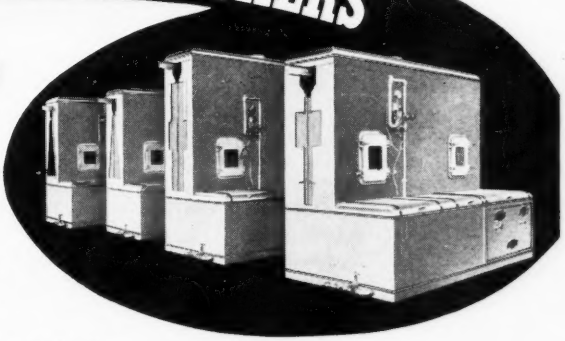

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mal vapor level, increasing vapor losses, and also carry the vapors to other parts of the room. The tendency to place degreasers near a spray booth is to be discouraged, because of the air effects of the more intense exhaust systems used there. If a location free from drafts is not available, shields are easily built to protect the machine from such drafts. The necessity of a proper stack with gas-heated equipment has been mentioned. If the degreaser is to be installed in a pit, the pit should be connected to an effective and properly placed exhaust system and must be large enough to permit ready access to all clean-out doors. The working height of the tank should be carefully considered, to enable the operator to work comfortably and safely.

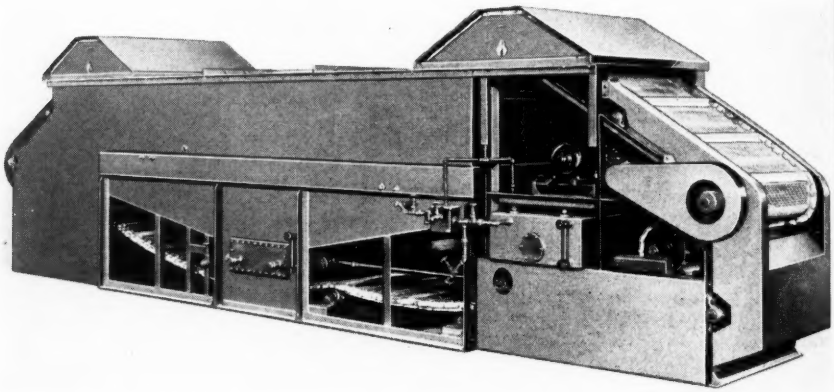

Fig. 4—This illustration shows a view of a through-type vapor degreaser equipped with a mesh belt conveyor for the full automatic cleaning of automotive parts. Full automatic units of this type are said to eliminate the uncertainties of manual operation.

Operation—Probably the most important factor in proper operation of degreasing units is the speed with which the work is put into and removed from the tank. This rate should not exceed 11 or 12 feet per minute, effective vertical lift, to prevent unduly disturbing the vapor level and excessive drag-out. In those cases where the concentration of vapor in the air near the unit is too high, too fast a rate of handling the work is often responsible. A unit of sufficient capacity should therefore be chosen originally (1) to permit not only the proper rate of working but also (2) to permit the work to be left in long enough to reach the temperature of the vapors so that it can be removed dry and not drag out liquid solvent and (3) to avoid the necessity of using a load heavier than the unit was designed for, which would disturb the heat balance and therefore the efficiency of the unit. Cup-shaped work should be drained inside the degreaser. The practice of pouring solvent over pieces too big to completely fit within the tank should not be permitted. In spray or slush type units the stream of solvent should be directed below the vapor line in the degreaser. Naturally the condensing water, heater, vapor level, and accessories (such as exhaust, if used) should be working properly be-

fore work is actually commenced. Finally, the unit should be cleaned out at proper intervals and in the proper way and the tank should be suitably covered when not in use.

In all these details of equipment, installation and operation, solvent and equipment suppliers are well able and very willing to advise. Printed instructions and periodic service visits and inspections are made available by them to their customers and proper attention to these is the best insurance of economical operation of the degreasing processes. As always, of course, there is the human element to consider, so that the most fool-proof arrangement is, whenever possible, the enclosed degreaser unit with conveyor feed.

In conclusion, and summarizing the situation of solvent degreasing today, it seems fair to say that this process forms one of the most useful metal cleaning methods in use, and that from a health point of view there need exist no hazard if

1. The unit is properly chosen as to type, size and engineering design.

2. The installation is properly executed in the proper location.

3. The operation, particularly the rate of loading and unloading, and the maintenance are properly heeded.

4. No foolish or negligent acts are committed, such as deliberately climbing into a tank still loaded with solvent, which is illustrative of only one actual case.

ACKNOWLEDGMENT

The author is glad to acknowledge the very helpful comments and data obtained from Messrs. M. Bowditch and H. Elkins of the Division of Occupational Hygiene and the Massachusetts Department of Labor and Industry in Boston, from Mr. S. W. Gurney of the Liberty Mutual Insurance Company in Boston, and from Mr. H. D. McKinley of E. I. du Pont de Nemours & Company in Wilmington, as well as the use of the general literature, some of which has been specifically mentioned in the text.

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Barrel Finishing of

A Continuation of the Study of Impact Marks Not Developed from Barrel Operation.

By H. LEROY BEAVER

Lansdale, Pennsylvania

THE barrel finishing paper for January discussed impingement and abrasion as those terms are generally understood in barrel finishing procedure. The present discussion might very well be considered as a part of that paper, but was not included last month due to the fact that it is of such major importance that it well deserves special treatment on its own merits.

If all of the digs, tics, scratches and indentations appearing on parts to be or having been barrel finished, could be directly attributed to some factor in the barreling operation itself, then barrel finishing would have much to answer for that would be distinctly not to its credit, and the process could never have attained its present wide vogue, nor could the interest in the various phases be sustained as it has been especially during the past four years.

Down through the past thirty years at one time or another we have had to listen to blame being attached to barrel finishing to cover every conceivable defect that might appear on a part from the time the strip steel reached the plant until the finished part was ready for assembly or shipment.

Previously, we have dwelt at some length on the handling of parts prior to the actual barreling operations and have pointed out where flaws and other objectionable marks could and are placed on parts long before they ever reach the barreling stage. Following this, we have discussed the various factors that make defects in actual barreling practice, but we now wish to discuss a factor to which little attention is paid in the average installation, but which is one of the most common sources for damage of parts in the entire barreling process.

It seems a bit strange that this factor should lie right in the barrel itself and yet not be actually a part of the barrel finishing operation. We have reference to the manner in which parts to be finished and burnishing material are placed in the barrel in making up the load for a normal barrel operating run.

If the reader will gather together a substantial file of catalogs of the various barrel manufacturers and study them, he will find that in almost every case, burnishing barrels,

whether of the high and narrow or long and narrow types, are shown in their loading position with the loading opening at the highest point. For example, high and narrow barrels will show the opening either at the very top of the barrel or between that point and an angle of about 80 degrees. Long and narrow barrels are shown in the loading position when the barrel stands vertical in its yoke, if of the yoke type, or with the opening at its highest point.

Now let us take a typical operator, with a load of parts and burnishing material with which to charge his barrel, and if we observe him carefully we will undoubtedly find this cycle of movements. First he shovels into the barrel a part of the steel burnishing material which of course forms a very dense and compact mass not in any sense resilient. On top of this he pours in, generally from a tote pan a quantity of parts, then back again to his shovel for another load of steel burnishing material which he pours into the barrel opening so that the entire load drops for distances of anywhere from twenty-four to thirty inches. The steel parts striking the parts to be finished cannot do other than cause distinct impact collision marks that no subsequent amount of barrel operation can erase.

After observing this operation time and time again there are operators

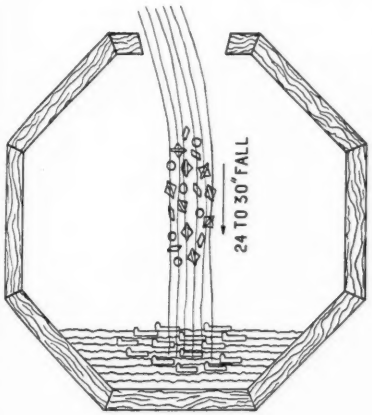


Fig. 1 — Illustration showing the incorrect method of loading a high and narrow type burnishing barrel. Burnishing material falling from a height of 24 to 30 in. causes nicks and indentations.

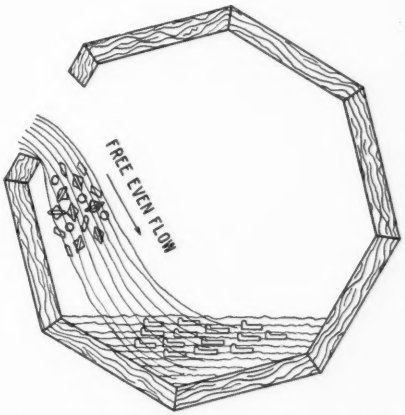


Fig. 2—A view of the correct position of a high and narrow type burnishing barrel when loading with burnishing material and parts. A free and even flowing mass of material will not cause defects in the workpieces.

who will persist in arguing that the very characteristic impingement marks are not caused in this way but that they develop somewhere in the barrel finishing process, and from the operation of the barrel itself. Perhaps we can explain more clearly the point we wish to stress with an outline drawing as shown in Fig. 1.

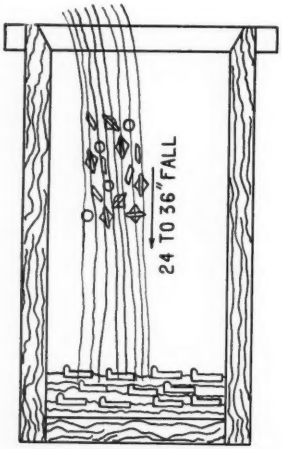


Fig. 3 — Illustration showing the incorrect method of loading a long and narrow type burnishing barrel. With the barrel in this position, any burnishing material that is poured into the mouth of the barrel will mar the workpieces being finished.

This figure illustrates a high and narrow type barrel such as an Abbott or Globe, with the loading opening at its highest point on the periphery of the barrel itself. The waved lines at the bottom of the sketch represent a part of the load of steel burnishing material, and the small figures a part of the load of stampings which are to be finished. Following the lines which project downward from the barrel opening toward the parts lying on the burnishing mass at the bottom of the barrel, we have sketched in what is supposed to represent a typical shovelful of steel burnishing material composed of balls and other steel burnishing forms. We believe this will illustrate very clearly the point we wish to make, namely that the impact of the burnishing material against the parts lying in the bottom of the barrel will result in defects, digs and tics which no amount of subsequent operating can erase. This sketch we would advance as a clear exposition of how not to load burnishing material and parts into a barrel.

Fig. 4—This drawing shows the correct position of the long and narrow type of burnishing barrel during the loading operation.

The correction of this condition is comparatively simple and is substantially as we illustrate in sketch Fig. 2.

This also represents a high and narrow type barrel same as in Fig. 1, but with the barrel opening brought down toward the operator, so that in loading either burnishing

material or parts from a shovel or tote pan, the materials are permitted to flow off the end of the shovel into the barrel without a distinct drop that would result in collision or impact marks. The objection has been raised that when this method of loading is used, at a certain point the barrel will have a tendency to roll forward toward the operator thus spilling out a part of the load. This is of course true, but the exercise of a little ingenuity on the part of the operator, such as an iron rod forked at one end to engage one of the cross bolts of the barrel will prevent this and yet not interfere with loading the barrel.

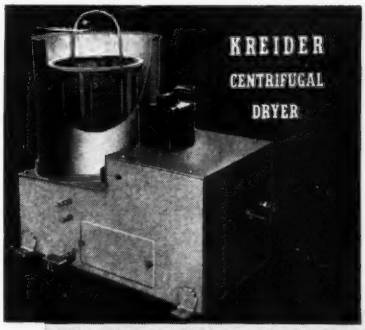
For barrel of the long and narrow type such as the Baird, and especially those models that are supported in a forked yoke, we have become tired of the argument that it is necessary to have this type of barrel in an absolutely vertical position for loading, because this is not true. Any supply house that caters to the garage trade can immediately supply four legged jacks, some with casters, which can be adjusted to a variety of heights, and it is simplicity itself to adjust one of these jacks so that the slope of these long and narrow barrels will be at an angle of from forty to forty-five degrees, and in this position loading is very much simplified.

Just as we have impact in loading the high and narrow type of barrels from their highest point we also have the identical condition on the long and narrow barrels when loaded in their vertical position.

Figure 3 represents a long and narrow barrel shown in the customary position in which it is loaded, and where the same characteristic marks are impinged on the surface of the parts to be finished as obtained in the same manner in loading a high and narrow type barrel. The sketch also shows a bed of burnishing material on the bottom on which are shown parts to be finished and a shovel full of steel burnishing materials dropping down on these parts from the lip of the barrel.

Just in the same sense that we bring the opening of a high and narrow barrel downward and toward the operator, we can do the identical thing with the long and narrow type by tilting it in its yoke to an angle for loading as shown in Figure 4. In this position, with the jack underneath the bottom angle of the barrel, it will be comparatively easy to permit the burnishing material to simply flow over the lip of the barrel and find its way into the bottom of the barrel without impact on any of the parts to be finished.

Some operators will say that by this method it is impossible to fill the barrel completely full, which we



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consider to be a very distinct advantage. We have never subscribed to the full barrel theory and perhaps we never will unless someone can clearly point out any advantage in such a method of loading. There is only one

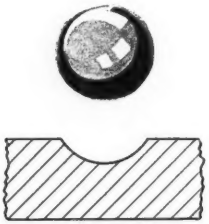

Fig. 5—This drawing will help to identify the type of indentation that is made by a burnishing ball in striking a flat workpiece.

case in which such a loading method could be considered and that is where the specific gravity of the parts to be finished was so much less than that of the burnishing material that the parts would be forced out of the mass, and be what many operators term "floaters." We have also previously discussed ways and means for handling such a condition when it arises.

If there is doubt in the mind of any of the readers of this series, that these impact marks do occur in just the manner described, he need only lay several pieces of stampings, or other small parts on top of the burnishing material in his unloading pan assembly. Then simply pick up handfuls of the burnishing material and pour them down on the parts from heights varying from twenty-four to thirty inches, which would be roughly equivalent to the distance the burnishing material would drop from the lip of his loading shovel. It will not take much of this sort of performance to convince the operator that the suggestions contained in this discussion merit his studied attention.

Now, how are we to distinguish these impact marks? This is simple too, because a round ball will form an indentation not unlike that formed by a Brinell ball in making a hardness test. It is true that the indentation will not always be as deep, but it will have the same general characteristics as shown in the cross section sketch Figure 5. Of the formed burnishing pieces, which we will designate as Balcones, Finbals, Diagonals and Diamonstels we get a different sort of indentation which is more generally represented as an ellipse, also substantially as shown in the illustration Figure 6.

It must not be overlooked, too, that even the parts to be finished themselves will cause nicks and defect marks when dropped from the same heights as steel burnishing forms, but in most every case these marks differ from the marks caused by the impact of burnishing materials. Generally in stampings, where such marks are observed, it will be noticed that we will have the impact mark, and then leading from this mark will be a fine area of scratches caused by

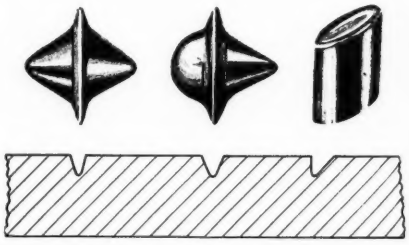

Fig. 6—This drawing shows the characteristic impingement marks made by the various types of formed burnishing material.

the edge or burr of the stamping itself. These fine scratches are not evident when the mark has been caused by the steel burnishing material. The flanges of Balcones, Finbals or Dou-

ble Cones, and the points of Diamonstels and Diagonals cause the elliptical marks while the rounded sections of these parts will cause indentations not unlike those caused by a round ball itself.

Quite recently we had a brass stamping submitted to us on the face of which were six very distinct impact marks. We took this stamping, laid it on a solid bed of steel burnishing material and then by dropping ¼ in. Burnishing Cones directly on the stamping we were easily able to duplicate the original impacts to the number of thirty-two, none of which could be distinguished even under magnification, from the original six marks on the piece as submitted.

A number of readers have asked what length of hose we suggested to use on the discharge end of the compressed air loader discussed a couple of months ago, and the answer is, and is given in this connection, because the hose length should be such as to deflect the incoming burnishing material to the side of the barrel to prevent impact marks such as are herein described.

Following the system of easy flowing loading as herein described is not at all difficult and will do much to improve the appearance of your work and prevent rejected parts.

Paint Progress, Vol 2, No. 1. This issue contains a seven-page article entitled "Painting for Defense." It is the first comprehensive treatment of the subject which has appeared in any literature and tells not only the volume of paint involved, but what paints will be used and where they will be applied.

Copies of "Paint Progress" can be obtained by writing to The New Jersey Zinc Company, 160 Front St., New York City.

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News OF THE INDUSTRY

Buffalo A. E. S. Educational Meeting

The Buffalo Branch of the American Electroplaters' Society will hold a joint Educational Session with the Toronto, Canada, Branch, February 8, 1941, at the Fox Head Inn, Niagara Falls, Canada. Guests will include the Rochester Branch, and the Western New York Division of the Electro Chemical Society.

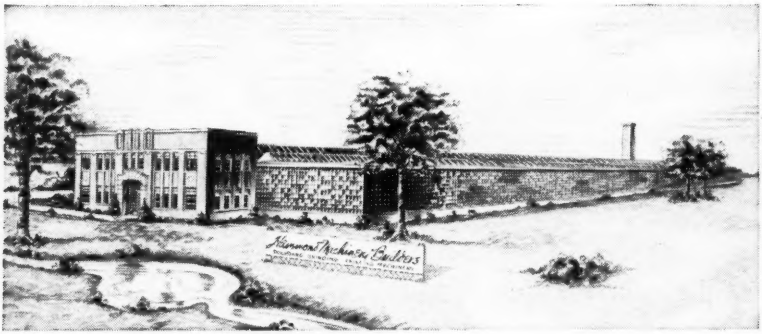
A fine group of speakers, including Mr. F. F. Oplinger, Mr. Frank C. Mesle, Mr. Geo. B. Hogaboom, Sr., and Mr. F. E. P. Griggs, will also be present.

Hammond Acquires Additional Factory Space

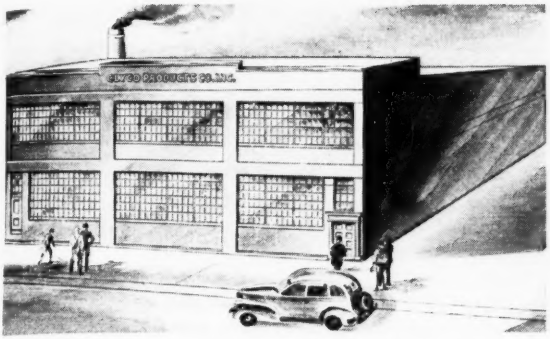
Customers anxious for delivery or factory service will have no difficulty getting reasonable shipping schedules from Hammond Machinery Builders, Inc., 1622 Douglas Ave., Kalamazoo, Michigan.

Last month, this 60-year-old firm, manufacturer of a prominent line of grinding and polishing machinery, expanded to fill a new, ultra-modern plant addition providing more than twice the elbow-room formerly available for manufacturing space.

In another division, a new processing room has been set up and equipped with late model Hammond polishing and grinding machinery. Prospective customers who wish to determine how Hammond grinding or polishing machines will handle their work will submit samples. They will be processed on the machine in which the customer is interested, then returned for further consideration.



A view of the new addition to Hammond Machinery Builders plant.



Architect's drawing of new offices and plant of Glyco Products Co., Inc.

Glyco Products Approves Plans for New Quarters

The Glyco Products Co., Inc., 148 Lafayette St., New York City, has approved plans for its new building in Brooklyn, N. Y. This will consist of three sections, the administrative, research laboratory and manufacturing divisions. New manufacturing equipment of stainless steel is being specially designed. The research laboratory will include additional pilot plant and pilot auxiliary equipment. Exceptionally high head-room for the manufacturing unit will make possible the installation of specially designed refluxing and distilling units.

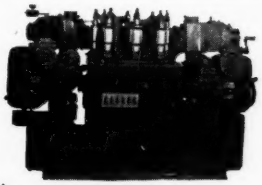
Ample space for the installation of additional equipment for new processing and future expansion is now available. The shipping and receiving department has a three-car railroad siding, and two enclosed trucking pits. Fronting on the deep water Atlantic Basin makes it possible to receive and ship by water most expeditiously. The administration building and research laboratory will be located at 228-236 King St., and the shipping and receiving departments will be at Pioneer St. It is anticipated that operations will be completed early in 1941.

Magnus Appoints Four Representatives

Magnus Chemical Company, Inc., 10 South Ave., Garwood, N. J., manufacturer of cleaning materials, industrial soaps, metallic soaps, emulsifying agents, and metal working lubricants, announces four appointments as follows: Paul Blanchard as sales representative in Scranton, Pa., and vicinity; Henry W. Scott becomes resident sales representative in Southeastern Florida; Walter E. Winship will represent Magnus in the state of Louisiana and southeastern Mississippi; J. H. Welch as sales representative in Arkansas and the western part of Tennessee.

Dernell Named Southern California Manager for Ault & Wiborg

William H. Dernell, associated for 20 years with the Ault & Wiborg Corporation, 75 Varick St., New York City, has been named district manager of South-



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ern California for A & W, with offices in Los Angeles, California.

Prior to his connection with A & W, in the early days of the airplane indus-

William H. Dernell

try, Mr. Dernell was associated as an aeronautical engineer with Curtis Aeroplane Company, Boeing Airplane Company, and Whittemann Aircraft Corporation. After leaving college, he practiced civil engineering for several years, and then joined the staff of Thomas A. Edison as a production manager of cabinet manufacturing.

Mr. Dernell joined Ault & Wiborg as an industrial engineer, later becoming manager of the Cincinnati plant. For a number of years he has handled sales activities, more recently having been manager of the Buffalo district.

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Herman L. Cook Joins Enamelers Guild Division of O. Hommel Company

Mr. Herman L. Cook, widely known ceramic engineer and enameling superintendent of the Norge Division, Borg-Warner Corporation, Muskegon, Mich., has severed his association with that concern to accept a position on the staff of the Enamelers Guild Division, O. Hommel Company, Carnegie, Pennsylvania.

Mr. Cook's accomplishments in the furtherance of efficient porcelain enamel production are well-known in the porcelain enameling industry.

In his new association Mr. Cook will aid in coordinating new porcelain enamel frits developed by the Enamel-

Herman L. Cook

ers Guild Research Department and Laboratories with the cooperation of the Hommel Industrial Fellowship at Mellon

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DeVilbiss Training School

The DeVilbiss Company, 300 Phillips Ave., Toledo, Ohio, manufacturer of spray painting equipment, has announced the schedule of its training school for spray painting equipment users for five months of 1941.

This school, which is open to industrial painters, master painters, automobile refinishers, and all others interested in learning the technique of spray painting and the use and care of spray painting equipment, will be held at the company's Toledo, Ohio, plant.

Dates for the start of each training period are: February 17, March 17, April 21, May 19, and June 23. Sessions will last for one week, each.

Proctor Diamond Jubilee

A Diamond Jubilee celebration will be held by the New York Branch of the American Electroplaters' Society in honor of the 75th birthday anniversary of the founder—Charles H. Proctor—on February 22, 1941, at the Hotel Pennsylvania, New York City.

The celebration will include an informative educational session, a fine dinner in the famed Manhattan Room, a floor show of merit, and a well-known dance orchestra. Those who wish additional information regarding the Diamond Jubilee celebration should get in touch with Mr. Franklyn J. MacStoker, chairman, 25 Princeton St., Garden City, New York.

Harry C. Brainard Joins Industrial Lubricants Staff

Industrial Lubricants Co., Inc., 5736 12th St., Detroit, Mich., makers of Grainlock polishing wheels, cement, and Drawco drawing compounds, announces the addition of Harry C. Brainard to the sales and service department. Mr. Brainard, one of the pioneers in the development of polishing techniques for use with stainless steel, comes from the polishing-grain cement department of the Park Chemical Co., Detroit, where he has serviced major accounts in the territory for the past six years.

Harry C. Brainard

"Rapidly increasing acceptance of Grainlock products has made it necessary for us to expand both with respect to manufacturing and sales," said A. J. Weissmiller, president, in making the announcement.

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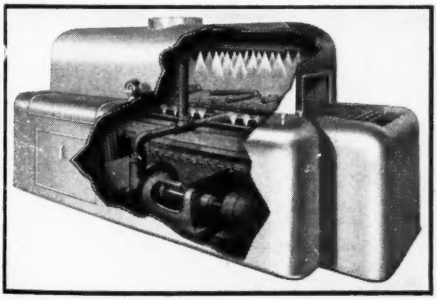

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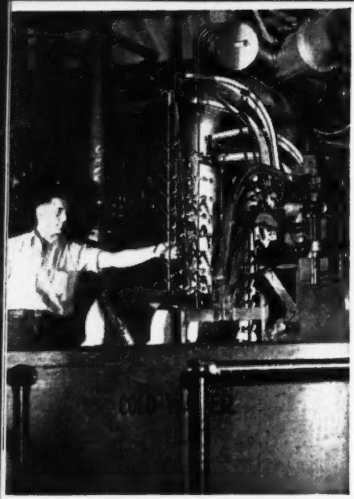


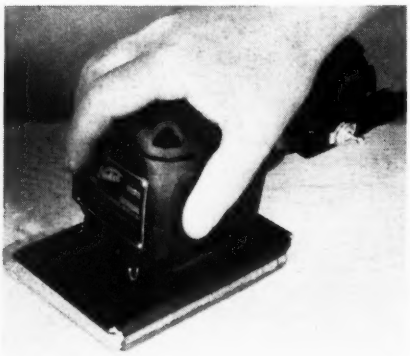
New PLANT EQUIPMENT AND Materials

Nedco Model "R" Reciprocating Sander

The Nedco Company, 87 Rumford Ave., Waltham, Mass., has placed on the market a single speed type reciprocating sander to be known as the Nedco Model "R" Sander. This unit is said to have a radically different design of mechanism and to excel in speed.

The Nedco Model R Sander is powered by a light, compact motor, the power being transmitted through a floating mechanism of high efficiency to the pad resulting in a positive action. Oversize, grease-sealed ball bearings are used throughout. The machine is light in weight, weighing only six pounds, and is built for long life.

The compactness of the unit is said to permit its use where close tolerances are encountered. The unit is designed with an extra rapid stroke. The Nedco Model R Sander is recommended for sanding and rubbing filler materials which are used in the finishing of machine tools, and similar work.



Nedco Model "R" Reciprocating Sander

Ply No. 9 Skin Protecting Material

The Milburn Co., 905 Henry St., Detroit, Mich., announces a new formula known as Ply No. 9, created specifically for industries where perspiration of the hands is injurious to both workers and products. Manufacturers of high-precision bearings and other aeroplane parts, where normal perspiration causes rust spots, are said to find Ply No. 9 particularly useful. Users of new synthetic finishes are also said to find extensive use for Ply No. 9, since the material is designed to eliminate the irritations that cause industrial skin disorders.

Ply No. 9 Skin Protecting Material is offered commercially in the form of a water-like colorless solution. The worker dips his hands into the solution and permits the moisture to dry on his hands. As it dries, Ply No. 9 forms a very fine, invisible film that provides protection for the worker and for the product on which he is working.

Clinical experiments have shown that Ply No. 9 causes a rapid drop in the perspiration accumulated on the surface of the skin. It also tends to decrease the oily secretions of the skin and remove the alkalinity that occurs de-

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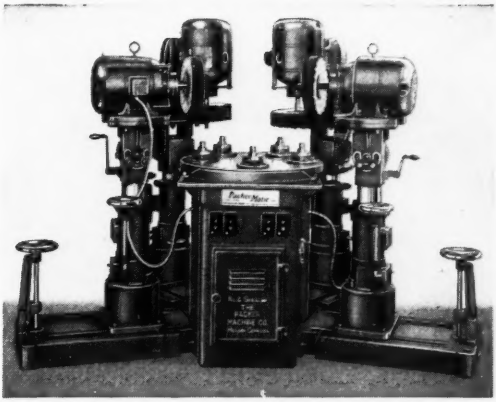

PACKER-MATIC No. 4 ROTARY TYPE complete with Automatic Composition Applicator, centralized control for economical operation.

Six faces and each must shine with brilliant sales appeal! On a PACKER-MATIC it's easy—automatically rotating on their own centers, volume parts such as these are Buffed with a mirror-like finish at an enormous saving in time and finishing cost. Hex. and octagon shaped parts are not the unusual on PACKER-MATIC—the Wheel Heads set at any degree plus the variable speed operation of the Work Table, make seemingly difficult Polishing and Buffing, a simple, regular job on a PACKER-MATIC.

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spite other precautions. However, a coating of the material on the hands is, the manufacturer states, positively without detrimental effect to the body. It is also said to be completely inactive with respect to the metals or finishing processes in plating operations. In addition, like all Ply formulae, the No. 9 material is easy to apply as well as to remove, and is designed so as not to penetrate the skin or react with basal living cells.

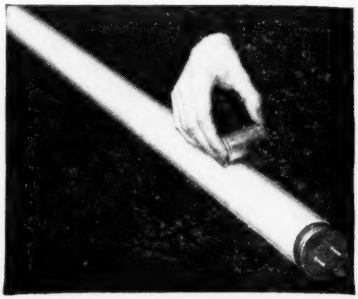
The outstanding qualities of Ply No. 9 Skin Protecting Material are of particular significance to those engaged in the manufacturing of explosives, dyes, textiles, and finishes, besides those products mentioned above.

Westinghouse 100-Watt Fluorescent Lamp

A 100-watt Mazda fluorescent lamp, the largest yet made and possessing over twice the power of any Mazda fluorescent lamp heretofore manufactured for commercial and industrial purposes, has just been announced by the Westinghouse Lamp Division, Bloomfield, New Jersey.

Five feet long and 2⅛ in. in diameter, this unit will be available in a white color, which has proved most popular and adaptable to the greatest number of uses. The 100-watt lamp adds a seventh size to the line of fluorescent lamps now being manufactured by this company.

The lamp is intended for use in stores, offices, industrial plants, and elsewhere. Allowing higher mounting heights, it will reduce the size and number of fixtures necessary to supply a given amount of light. The new lamp has a rated initial output of 4,400 lumens and a rated life of 2,000 hours.



New Westinghouse 100-watt, five-foot fluorescent lamp shown with the FS-6 starter required for it. This glow-switch starter is 1⅛ in. in diameter, and two inches in length.

Additional information may be obtained from the Commercial Engineering Department, Westinghouse Lamp Division, Bloomfield, New Jersey.

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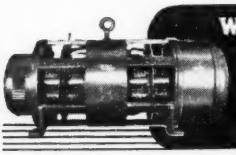
PERFECT SKIN PROTECTION
A soft cream which when applied to the hands, arms and other exposed surfaces dries in a minute to a thin, invisible tough film that protects against paints, lacquers, enamels, dirt, grease and grime. Removed with ordinary toilet soap and water leaving the skin fresh, clean and smooth. Used in industrial plants throughout the U.S.A. Giant Tube, 50c; Qts., 85c; Gals., $2.50, delivered. Ask, on firm letterhead, for free sample.
DOSTER & CO. 4831 RICE ST. CHICAGO

Nalco 13 Light Infra-Red Ray Unit

A portable infra-red ray unit designated as the "Nalco No. 13" lamp unit for radiant energy baking, heating, drying, and dehydrating has been placed on the market by North American Electric Lamp Company, 1020 Tyler St., St. Louis, Mo. This portable unit is mounted on casters and can be easily moved into any desired position. The "Nalco 13" lamp unit can be tilted to any angle and may be swung over into a vertical posi-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tion as well as the horizontal.

The Nalco "13" lamp can be raised to a height well over 8 ft. and can be dropped to within 12 in. of the floor.

Nalco 13 Light Infra-Red Ray Unit

This unit is sufficiently large to dry a surface approximately 4 ft. by 6 ft. wide, either greater or less, depending upon the distance it is placed from the surface of the workpieces to be dried.

Switches are mounted on each row of lamps so that a combination of 4, 9, or 13 lamps, depending upon the area to be covered, may be used. Standard equipment of the Nalco "13" lamp portable unit includes 15 ft. of cord with plug, 13 7⅞ in. polished aluminum reflectors, and 13 260-watt, G-25 Nalco dritherm carbon filament lamps.

Leiman Type C Sandblast

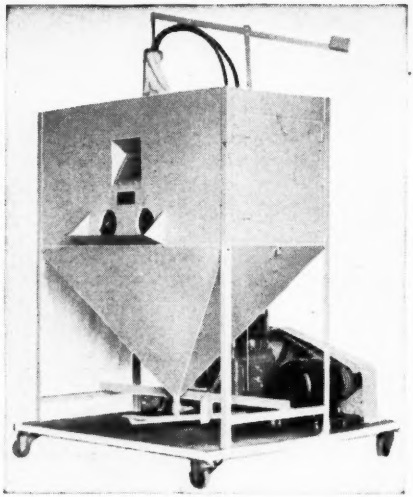
Shown herewith is the Leiman Type C Sandblast which has been brought out by Leiman Bros., Inc., 101-W Christie St., Newark, N. J. The sandblast is suitable for large, bulky workpieces up to approximately 2 ft. square. A door is provided on each side of the machine for inserting the workpieces.

The cabinet is of dust-tight construction, thereby preventing dust from getting into the room and being inhaled by the operator. The small amount of dust arising from the sandblast operation can be vented outdoors or to dust separator. The interior of the cabinet is illuminated by means of an electric light fixture, and a vision glass is provided in the cabinet for use by the operator in observing the sandblasting operation. The glass is protected from the sandblasting action so that it does not become dim, glazed, or frosted.

The cabinet is so constructed that the operator can use both hands to guide the blast nozzle, cuffs being provided to seal the two arm openings against possible leakage of dust. Rubber gloves can be attached to the front arm openings in the cabinet for protecting the hands.

Due to the light, flexible construction of the hose, the sandblast nozzle can be easily moved about. This easy movement is aided by a counterbalancing mechanism located at the top of the cabinet. The nozzle gun can be furnished to operate with a low air pressure of only 5 lb. or is available for operation with higher air pressures up to 100 lb. The amount of air pressure depends upon the class of work and the speed of production.

The Leiman Type C Sandblast is designed for use with any abrasive such as sand, flint, or steel grit. The flow of the abrasive can be adjusted at the mixer cup where it is readily observed. Starting and stopping of the blast ac-



Leiman Type C Sandblast

tion is controlled by a foot treadle which turns the compressed air on and off. The Type C sandblast requires from 20 to 70 cu. ft. of compressed air per minute for operation.

Grainlock Polishing Belts

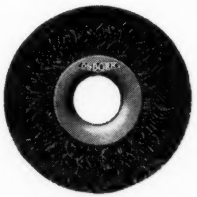
Industrial Lubricants Co., Inc., 5736 Twelfth St., Detroit, Mich., manufacturer of Grainlock Polishing Wheel Cement and Grainlock Polishing Wheels, now offers Grainlock Polishing Belts for all types of polishing operations.

The new Grainlock Polishing Belts feature an exclusive interwoven-splice which eliminates all overlapping and maintains uniform thickness at all points. This is said to provide smooth, trouble-free performance. All Grainlock Belts are, in addition, thoroughly pre-stretched to prevent sagging.

Osborn Ringlock Wire Brush

An outstanding development in the manufacture of power driven wheel brushes has been announced by the Brush Division of The Osborn Manufacturing Company, 5401 Hamilton Ave., Cleveland, Ohio, manufacturer of Osborn Brushes. It is the Ringlock method of construction, which securely locks in the brush material by means of a one-piece ring and a sleeve. The design provides a dense brushing surface and reduces breakage of the brush material to a minimum.

With this compact, streamlined Ringlock construction, wire wheel brushes can now be made successfully in diameters as small as one inch, other diameters ranging up to 12 inches. The dense brushing surface makes the brushes fast-working, efficient tools.



Osborn Ringlock Wire Brush Section

Tampico wheel brushes for cleaning, buffing, and polishing metal are also made by the Ringlock method.

"Glazing Shoulders" Before Mirror Finishing with 4F Turkish Emery

The W. R. Case & Sons Cutlery Company, Bradford, Pa., uses "Indian Brand" 4F Turkish Emery to glaze shoulders of knives before mirror finishing.

"Indian Brand" Turkish and Naxos Emery and "Hecco Brand" American Emery are absolutely uniform and of the highest quality . . . they have greater capillarity and longer wear . . . they will be delivered promptly.

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DeVilbiss Paint Circulating System

Manufacturers will be interested in the small paint circulating system for finishing room use recently announced by The DeVilbiss Company, 300 Phillips Ave., Toledo, Ohio.

This system is of special interest to the smaller manufacturer because it makes available to him all of the economies, safety, and the convenience represented in the circulating system of paint delivery.

DeVilbiss Small Paint Circulating System

The DeVilbiss Type QBM Small Circulating System will supply a maximum of six production-type spray guns in continuous operation, handling such materials as lacquers, synthetic enamels, paints, varnishes, shellacs, and so on.

The heart of the new system is the tank assembly. The container is a standard Type QM unit with agitator, 30 or 60-gal. capacity. The motor-speed reducer pump combination mounted compactly on a small platform on the lid of the tank, has been designed especially for this application. Either air or electric motors are available.

Both air and electric motors are of sufficient capacity to circulate fluids with a maximum viscosity of 25 seconds, determined on a No. 4 Ford cup, against an average loop pressure of 50 lbs. per square inch.

The pump on the DeVilbiss QBM System is the newly improved Type QB. It has no packing gland, incorporating, instead, a unique mechanical seal which ensures much greater resistance to wear.

Three QBM Systems are available. System "A" is the simplest in design and the least expensive to install. It delivers fluid over a loop no longer than 200 ft., with a minimum internal diameter of one-half inch. In this system the material is forced throughout the loop by air pressure, while the pump is required merely to keep it in motion to prevent precipitation. Material enters the loop only as it is used and is not re-circulated through the tank.

With "B" the loop can be as long as 450 ft., with a minimum internal diameter of three-quarters of an inch. Included are individual fluid regulators for each gun, thus providing more accurate fluid pressure control than is possible with System "A." The material is kept more uniformly mixed by being constantly re-circulated through the tank by means of the pump which produces a pressure in excess of that in the tank.

With System "C" the fluid is re-circulated through the head of each gun. This is recommended for materials which are difficult to keep in suspension or which otherwise alter their physical characteristics when allowed to remain stationary for relatively short periods. With this system, individual fluid pressure regulators for every spray station are provided, as well as a relief valve at the beginning of the low pressure return side of the loop. Piping should be limited to a minimum internal diameter of one-half inch and 200 ft. length.

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Republic Multi-Edge Anode

A ten corner lead anode for chrome plating to be known as the Multi-Edge has been placed on the market by Republic Lead Equipment Co., 7924 Jones Road, Cleveland, Ohio. The ribs of the Multi-Edge anode are beveled to provide a higher degree of strength and rigidity, and reduce the tendency to curl.

The Multi-Edge anode is made by the extrusion process, giving a firm and dense texture to the land. The anode measures ½ in. thick by 3 in. wide and is available in practically any length. Each anode is stenciled for height of solution level.

The Multi-Edge anode is provided with knife-edge or flat hooks, shaped to the user's specifications. The hooks are "burned in" by the homogeneous lead burning process, thus assuring positive electrical contact and conductivity.

Republic Multi-Edge Anode

The materials used in the manufacture of the Multi-Edge anode have been carefully selected and the workmanship is of the highest quality.

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1020 Tyler Street St. Louis, Mo.

Yohe Five-Arm Rack

A five-arm stock rack designed to provide a 20 per cent increase in carrying space and to increase the proportion of stock stored at convenient shoulder height is now being marketed by Wm. S. Yohe Supply Co., 501 Gibbs Ave., N. E., Canton, Ohio. The rack occupies no more floor space than the same company's standard four-arm rack and, like the latter, is self-balancing.

The five-arm rack, cast of high grade machinery iron stands only 57 in. high, has arm capacity of 10-in. diameter, with opening over hooks of 4¼ in. Yohe racks can be located against a wall or in any position in the shop, either singly or with backs overlapping. The flexibility thus obtained permits the storage of all types of bar or tube stock. Both four and five-arm racks are available.

Kem Save-Lite

A synthetic mill white which is said to cover with one coat and dry overnight to a hard tile-like surface is now being marketed by The Sherwin-Williams Company, 101 N. W. Prospect Ave., Cleveland, Ohio. This finish is recommended for plants where unusual conditions require maximum durability, fast drying, and extremely sanitary washable surfaces.

Kem Save-Lite white finish is said to have exceptional resistance to moisture and reflects and diffuses as much as 89 per cent of the light entering a plant.

Hammond Abrasive Belt Polisher

Hammond Machinery Builders, Inc., 1622 Douglas Ave., Kalamazoo, Mich., has recently brought out an abrasive belt stand for use in conjunction with polishing and buffing lathes.

The illustration herewith shows the abrasive belt stand with a Hammond Model 7-CH Rite-Speed Lathe. The abrasive belt polisher shown here is equipped with five inch belt. However.

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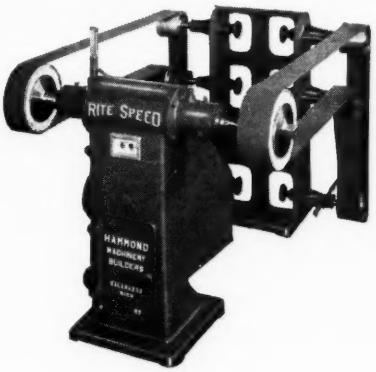
wider or narrower belts can be furnished to suit particular requirements. Proper tension of the belt is maintained



Hammond Abrasive Belt Polisher

by an adjustable tightner pulley and the belt can be quickly removed and replaced.

Sturtevant Downblast Speed Heater

A unit heater recently developed by B. F. Sturtevant Company, Inc., 16 Damon St., Hyde Park, Boston, Mass., to be known as the "Downblast Speed Heater," is designed to supplement the company's line of floor type and standard type suspended heaters. The Downblast Speed Heater, as its name implies, projects heat directly downward, which is said to result in more efficient heating for certain installations. Because the heat is driven down at high velocity, the Downblast Heater is particularly suited for installation in buildings with high ceilings, above crane rails, or wherever an unusually high installation is desired. The largest size of Downblast Heater is said to provide effective heating even when suspended 40 ft. above the floor level.

The Downblast Speed Heater is not limited to high installation. Where a comparatively low installation is desired, deflection cones—illustrated in the sectional drawing shown herewith—are left on, resulting in wider diffusion of the heated air stream and temperature reduction at the working level. For

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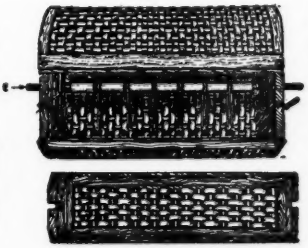

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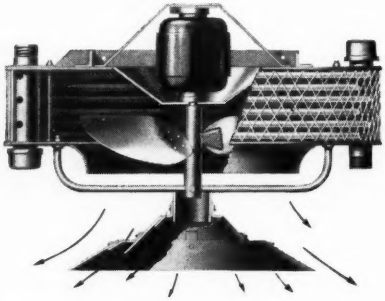
high installations, deflection cones can easily be removed to obtain greater downward velocity of the heated air.

Other Downblast Speed Heater features include: fuel saving, according to the manufacturer, the heat is kept away from exposed ceilings where the greatest heat losses occur and is forced down to working levels, maintaining an almost uniform temperature from breathing zone to the ceiling; better heat distribution in congested areas, such as in long narrow passages between stock room shelves; and elimination of conflicting air streams.



Sturtevant Downblast Speed Heater

Structurally, the Downblast Speed Heater consists of a circular extended surface heating element protected by a screen guard, with copper tubes brazed into copper headers forming a homogeneous unit. Fins are of aluminum for maximum heat transfer. Room air is drawn into the heater through the heating coil projected downward by a rugged aluminum fan with three die-stamped blades riveted to a cast hub. Headers on both sides of the coil permit rapid cleaning of condensate. Headers have threaded connections at either end, allowing steam lines to be connected to the most convenient side. This makes installation easier and saves pipe.

Twelve sizes of Downblast Heaters are available, with capacities ranging from 40,000 to 400,000 b.t.u. per hour at two pounds steam, 60 degrees entering air.

Hygrade "Mirastat" Fluorescent Lamp Starter

Hygrade Sylvania Corp., Salem, Mass., announces an improved fluorescent lamp starter to be known as the "Mirastat," which is available in three sizes; namely, the Nos. 2, 4, and 6. Mirastat No. 2 is designed for use with 15 and 20-watt fluorescent lamps, Mirastat No. 4 for use with 30 and 40-watt lamps, and Mirastat No. 6 for use with 100-watt lamps. All Hygrade Miralumes are now being equipped with the starter.

Improvements claimed for the Hygrade Mirastat Starter include elimination of "sputtering," due to proper preheating of lamp cathodes; retardment of blackening at the end of lamps; longer lamp life, and definite, accurately-timed starting and re-starting. Wattage consumed is approximately ¼ watt.

The Mirastat is approved by the Underwriters' Laboratories. It operates with fluorescent lamps on either direct or alternating current. The starter circuit includes a condenser designed to minimize radio interference. Compensation is made for temperature so that the starter operates satisfactorily over a wide range of surrounding temperature conditions. The Mirastat is interchangeable with glow relay type of starters since it uses the same type of socket.

Correction

The "Empire Pressure King" portable spray outfit described on Page 75 of the 1940 Finishing Review issue of Products Finishing is now being marketed by Campbell-Hausfeld Co., Harrison, Ohio.

Opportunity Section

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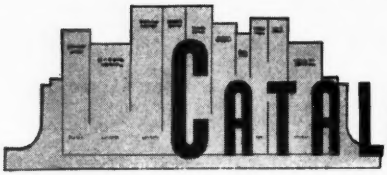

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To obtain copies of the catalogs listed here, indicate on the coupon the number of the item in which you are interested and mail as directed.

1. Cowles Heavy Chemicals

An interesting six-page folder describing Drymet, Crystamet, and Dryorth, three metal cleaning compounds, is now being issued by Cowles Detergent Company, 7016 Euclid Ave., Cleveland, Ohio.

2. General Electric Reactrol System

Eight ways in which the Reactrol system gives exact temperature control are described in a bulletin now being issued by the General Electric Company, Schenectady, New York.

3. Heatbath Metal Treating Chemicals

A beautifully illustrated catalog describing Pentrate finishes for steel products is now being issued by Heatbath Corporation, P. O. Box 18, Springfield, Mass.

4. Finishing Equipment Catalog

A very complete catalog illustrating and describing finishing equipment of all kinds is now being issued by Industrial Sheet Metal Works, 630 E. Forest Ave., Detroit, Michigan.

5. Airway Ventilated Buffs

Cool cutting buffs for high speed buffing operations are illustrated and described in a 4-page folder now being distributed by Jackson Buff Corporation, 21-03 41st Ave., Long Island City, New York.

6. Dust Control

A complete story of dust control in words and pictures by means of Roto-Clone dust control equipment is now being issued by American Air Filter Company, Inc., 702 Central Ave., Louisville, Kentucky.

7. Cleaning of Metals Before Electroplating

A 32-page booklet outlining formulas and methods for cleaning many different metals and alloys before electroplating is now being issued by Oakite Products, Inc., 20 Thames St., New York City.

8. Rust Prevention for Iron and Steel

A description of Parkerizing, what it does, and how it is applied is contained in a book entitled "Parkerizing" now being issued by Parker Rust Proof Company, 2172 E. Milwaukee Ave., Detroit, Michigan.

9. Industrial Ovens

An illustrated industrial oven book featuring safety, speed, economy, and efficiency in industrial drying and finishing processes is now being issued by The Kirk & Blum Mfg. Co., 2816 Spring Grove Ave., Cincinnati, Ohio.

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